THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. JANUARY 2, 1896 CHICAGO, ILL. NUMBER 1.

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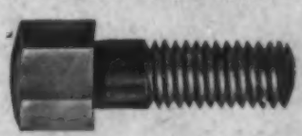

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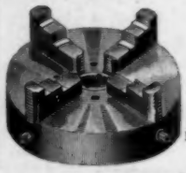

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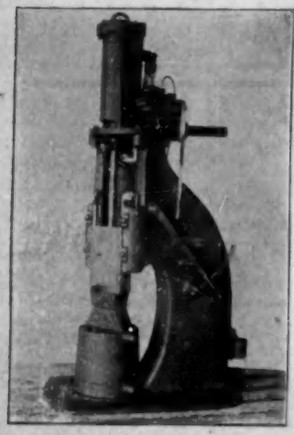

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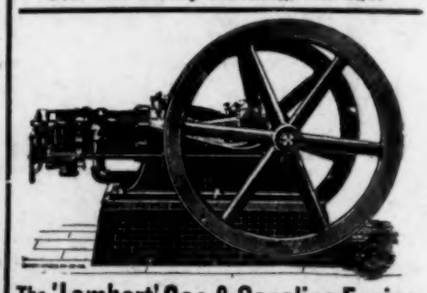

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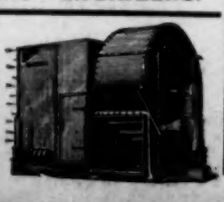

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. JANUARY 2, 1896. CHICAGO, ILL. NUMBER 1.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Market prospects, rather than current transactions, are occupying the iron trade of the country to day. Prices named in connection with late transactions in Bessemer pig and steel billets are not encouraging as to the future; but there are well known circumstances in connection with them that make them no gauge of what may be looked for one month, two months, three months hence. The $2 coke price is a reality, as has been demonstrated the past week, and it would appear that the circular announcement and contracts agree this time. The diversion occasioned by the statement from the Connellsville interest second in size, that it would sell at $1.25, has less significance, in view of the fact that 85 per cent of the Connellsville output is controlled by the Frick company. Contracts, it appears, are not to extend beyond 30 days, and the situation is subject to new action Feb. 1. The fact that presses with most force on the minds of furnacemen is that a sharp reduction of output will be necessary before there can be any improvement in prices. In the Central West this has begun. At New Castle, Pa., four furnaces are out because of the men's demand for higher Sunday wages, and the suspension may be protracted. At some Shenango valley furnaces the demand has been withdrawn, but there is still a feeling of uncertainty about future operations, and there is even more imminence of a demand by furnace operators for a wage reduction of 20 to 25 per cent. This may bring a situation that will cause a change in market conditions before the month is out. No attempt is longer made to maintain the agreement as to price on Southern iron, and not a little cutting is heard of from that direction. Foundry iron everywhere is unsettled as to price and transactions are reported indicating that quotations are shaded from 50 cents to $1 a ton where buyers are ready to contract ahead. Bessemer iron can be had freely at $10.25 valley furnaces, and a speculative transaction that netted the seller $9.90 valley furnace is authenticated. Billets have dropped to a corresponding level and $15.75 to $16 at Ohio River mill is the range of the few sales of the week, with $16.25 as the Pittsburg basis. It is plain that in Bessemer and steel billets the lowest prices have been seen, the end of December bringing the end of many speculative deals that caused loss to those who handled them and demoralized the market for the producer. Furnacemen have not lost sight, in the steady decline that speculative sales have brought, of the fact that higher coke and higher ore, even with some reduction in furnace wages, mean a cost at furnace of somewhere between $2 and $3 above to-day's basis for Bessemer pig. While the ore men are saying little, there is no expectation that they will permit conditions like those of the present moment to decide their destinies for the year ending May 1, 1897. The week's developments in finished material are of little import. Some buying of bar iron is promised in inquiries already received, shipments in January being made to the advantage of the buyer. There is nowhere any great tonnage of business on the books of the steel mills recently shut down, that was not taken before they went out for repairs. Prices have gone still lower on nearly all classes of material. The rail and nail trades stand alone in the maintenance of a figure out of relation to the general readjustment.

THE CLEVELAND DISTRICT.

It is giving the ore interests little credit for foresight to believe, as some of the going reports about ore prices for next year would imply, that the demoralization of the past few weeks in the Bessemer pig iron market is to be taken as the basis of calculations for 1896. Nor, on the other hand, is it to be expected that the action of the leading Connellsville interest, in establishing a $2 price for coke will be a criterion of what Bessemer ore producers will do, though the Connellsville stroke is regarded in some quarters as furnishing an effective argument in ore negotiations with at least one important steel company. The probability that the Mesabi producers of Bessemer ore will be included in the ore association is almost a certainty. It is believed there is but one company on that range that is not in full accord with the association's action and in that case the question is one of tonnage, with no insurmountable obstacles to its solution. The Mesabi companies show no anxiety to go into an indiscriminate competition. There has been no money made in mining on that range thus far, and it is believed an allotment of 3,500,000 tons of Bessemer ore to the Mesabi for 1896, including ore sold in 1895 but not shipped, will be accepted as the basis of an arrangement for 1896 that will give Mesabi mines a margin above cost. The differential between Mesabi and old range ores does not appear to be a matter of dispute.

Pig Iron. The four New Castle furnaces have been banked owing to the refusal of the companies to grant higher wages for Sundays and holidays. At the Spearman furnace at Sharpsville, the labor troubles of the past 10 days are now said to be settled. The probability that a demand for a reduction in wages will be made shortly by furnace operators in the two valleys may lead to further suspensions. Meanwhile the Bessemer market is at its weakest. A block of iron has been sold for delivery at a valley steel works at $10, and offers for the first quarter at $10.25 in the valley have been made. The coke advance at $2 has been a matter of general comment. One Ohio furnace is reported to have contracted for 1895 at a considerably lower price than $2, the coke coming from a producer who is cutting the circular price. The amount of $1.25 coke available, however, will not go very far. Foundry irons are weak and there is considerable cutting. Quotations of $13 and $13.50 in the valley for No. 2 and No. 1 respectively are cut sharply.

Finished Material. The holiday week has been exceedingly dull. Beams and channels are maintained by most mills at a 1.50c minimum, Pittsburg, but a lower price is reported on one transaction. Tank steel has sold at 1.40c Pittsburg, and steel bars at 1.15c. On bar iron, while 1.25c Cleveland, is generally maintained, 1.20c is a possibility on January business of desirable proportions. There is quiet a little inquiry but the reduced price has not yet brought any large business.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Christmas week was very quiet in all departments of the iron trade so far as orders were concerned, but it did not lack interesting features. In crude material the market appears to be in a very much unsettled condition, particularly in Southern pig iron. Some of the furnaces are claiming to maintain prices on the old basis, and others appear to be cutting present quotations a little. The local steel company closes down all of its mills except the sheet and plate mills Dec. 31, for an indefinite period. The mills have all been running for a long time, and will probably require considerable repairing, and the wage scale must be settled before they start up again. In structural material inquiry has been lighter, although one or two fairly good contracts have been closed.

PIG IRON.—Prices on Southern iron appear to be weaker and the quotation of $12.85 for No. 2 foundry has been cut. A few sales have been made, including one of 1,500 tons of softeners and one of 1,000 tons of Southern charcoal. In Northern coke iron very little business is being done, and quotations are maintained. Lake Superior charcoal is in good demand, and a few round lots have been disposed of at current prices. The inquiry for all classes of iron is large but it is impossible to tell when it will develop into actual business. Prices are made as follows:

Lake Sup. Charcoal	$14 50@15 50	Southern No. 2 Soft	$ @12 85
Local Coke Fdy. No. 1	14 50@15 00	South'n Silveries No. 1	@14 00
Local Coke Fdy. No. 2	14 00@14 50	South'n Silveries No. 2	@13 50
Local Coke Fdy. No. 3	13 50@14 00	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	14 50@15 00	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	14 00@14 50	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	13 50@14 00	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 2	@12 85	Alabama Car Wheel	17 00@17 50
South'n Coke No. 3	@12 60	Malleable Bessemer	
Southern No. 1 Soft	@13 10	Coke Bessemer	

BARS.—Only a small inquiry has been received, and sales are correspondingly light. Prices are made by association mills of 1.30c for delivery up to Feb. 1, and 1.35c beyond them. A meeting of the association will be held in Chicago, Friday of this week, but it is impossible to tell what action is likely to be taken.

RAILS AND TRACK SUPPLIES.—The local mills shut down Dec. 31, for repairs, and in the meantime are not taking orders of any size. Quotations are as follows: Rails, $29 and up; splice bars, 1.65c to 1.75c; track bolts, 2.25c to 2.45c; spikes, 1.95c to 2c.

BILLETS AND RODS.—No business has been done by the local mills and no quotations are available.

STRUCTURAL MATERIAL.—The San Francisco building, mentioned lately, was let last week, the material to be rolled by a Pittsburg mill. This contract calls for 1,000 tons of 20-inch beams, a remarkable order, and about 1,300 tons of other material. The Rock Island track elevation will take about 800 tons of material in the near future. An office building requiring a little over 1,000 tons of material is being planned, and will probably be in the market soon. Prices are lower, as follows: Beams and channels, 1.75c to 1.80c; angles, 1.50c to 1.55c; plates, 1.55c to 1.60c; tees, 1.75c to 1.80c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—A fairly good inquiry is current and sales of 50 to 100 tons are quite numerous. Quotations are made as follows: Tank steel, 1.55c to 1.60c; flange steel, 1.70c to 1.75c; firebox steel, 2.85c to 5c; boiler tubes, 60 to 65 per cent discount.

MERCHANT STEEL.—Business is rather quiet, and is expected to remain so until some time in January. Quotations are made as follows: Open-hearth spring, tire and machinery steel, 2.10c to 2.15c; smooth finished machinery steel, 1.85c to 1.90c; smooth finished tire, 1.80c to 1.85c; tool steel, 5 50c to 7.50c; specials, 11c and upwards; Bessemer bars, 1.55c to 1.65c.

SHEETS.—The market is very quiet and weak. No sales of any importance are reported. Quotations are made at 2.35c to 2.40c for No. 27 common. Galvanized iron is quoted at 75 and 10 and 5 per cent to 80 per cent off.

OLD RAILS AND WHEELS.—There is no business of any size going, and prices are only nominal. Quotations are made from $13.50 to $15 on old wheels. Old iron rails $16, and old steel rails $11 to $12, according to length, etc.

SCRAP.—Trade is very light, and dealers' views are not very hopeful as to the immediate future. The following are buying quotations furnished by dealers: Railroad forge, $11.50; dealer's forge, $10; No. 1 mill, $7.50; railroad cast, gross ton, $10; machinery cast, $11; axles, $14; cast borings, $5; wrought turnings, $6; axle turnings, $7; mixed steel, $8; stoveplates, $6 to $6.50; heavy melting steel, $10.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The certainty that January coke will be $2 has been Impressed on furnacemen in the past week. The advance is accompanied with the conciliatory assurance that buyers will not be asked to tie up to six months' contracts on this basis and that sales will only be made for 30 days' supply. Bessemer pig iron has not been arrested in its downward movement by the coke announcement. Speculators who have had to let go their holdings at what they could realize have crowded more metal on the market and the exceptional sale of a 5,000-ton block of Bessemer at $10 delivered at valley steel works, or $9.90 at furnace, is reported. There is little doubt that this price is considerably below any furnace's cost, on the present basis. It is believed, however, that most of the metal that has been used to slaughter the market is now out of the original buyers' hands, the speculators having in most cases confined their opertions to 1895 deliveries. While it is well known that steel mills are crowded with Bessemer pig and one large interest has stopped shipments into its yards, it is generally considered that the extreme of the slump has been reached and that while low prices will prevail for some time, furnacemen will have more to do with the market than in the past three months. With $2 coke, or 85 cents more than some furnaces have been paying it is plain that higher prices or a shut-down are the alternatives. The banking of furnaces at New Castle will have a firming effect on the situation, since it is plain that the production of pig metal is far beyond present or immediately prospective consumption. There is practically no market for gray forge and foundry irons. A sale of 500 tons of mill iron is reported at $10.90. No. 1 foundry is quoted at $13.50@$13.75, and No. 2 at $13, with no movement. Billets are exceedingly quiet and there is no prospect of an early demand from rod, wire or wire nail mills. A small sale at $16 Wheeling is reported for delivery in the first quarter of 1896; $15.75 to $16 Wheeling and $16.25 to $16.50 Pittsburg are prices named by mills, but there are few sales. There is no outlook as yet for railroad buying in 1896, and it is reported that nothing has been said about rail prices. Some sales of sheet bars are reported for the first half of 1896, and contracts are referred to, as low as $17 Pittsburg, though $18 has been the quotation. Structural mills have few orders ahead. There are rumors that the 1.50c minimum on beams and

channels up to 15 inches has been slightly shaded. The 6,000 tons of material, for the N. Y. appraiser's warehouse it is said will be rolled in Pittsburg. Tank steel is quoted 1.45c@1.50c, but the minimum is being shaded. Sheet mills note some good inquiries and anticipate a good run of contracts early in the year. The bar iron trade is slightly better since the reduction in price. It is reported that offers at 1.20c valley mill are made on deliveries before Feb. 1. Steel bars, strictly billet stock, have very few orders and prices are cut to get business. Old material is exceedingly dull. No. 1 wrought scrap at $12 and old iron rails at $16 represent the nominal market.

Buffalo. The local pig iron market has not been as dull and inactive during the week just past as could naturally be expected at this time of the year, and as inactive as seems to be the case in other districts. This activity is undoubtedly caused largely by the market here having been forced down to a point which makes it relatively lower than elsewhere. This situation has been taken advantage of and large contracts made for delivery during the first half of 1896, and, in some cases, for delivery through the entire year. Since the advance of 40c per ton in furnace coke and 30c in foundry coke, the iron and steel market is being watched more closely, and more interest shown than for some time past. It is not at all improbable that the advance just made in coke will prove the turning point, and early in the new year a much better feeling is expected to prevail in all branches of the iron business.

Cincinnati. "Reviewing the course of the pig iron market the past year, in connection with the situation at the close of 1895, Rogers, Brown & Co., say: The extraordinary expansion of the pig iron trade during the summer and early autumn received its impetus largely from the increased demand for Bessemer iron. There seemed scarcely a possibility of supplying the demand, and the price of Bessemer rose until it became profitable to import it, and contracts were made for large quantities of foreign ores which were brought over and idle furnaces put in operation to produce the metal sold ahead at a good margin of profit. The largest manufacturers of steel products, such as steel rails, billets, plates, structural material, and street rails, were flooded with orders, and buyers feeling the stimulus of the recognized activity willingly agreed to accept any deliveries the mills could make. The general sentiment was that good times had come again, and an era of business revival had been ushered in. While all this excitement was on and the advances that inevitably accompanied it obtained, there were conservative minds that were unable to comprehend it all, and did not participate in the belief that general prosperity was immediately ahead, as mercantile business aside from the metal interests gave no hint of sympathetic development, and the conditions of the national revenues and reserves were definitely unfavorable. When it suddenly became difficult to sell Bessemer pig, it was simultaneously discovered that many of the mills had anticipated their wants too liberally, and it was revealed that through about three months there had been a very extraordinary cumulation of orders for building materials, street car equipment, bridge iron, wire rods and the like, and that fresh orders were not forthcoming. The demand for manufactured products fell off abruptly, and the mills found no use for the surplus supplies of raw material being delivered to them so bountifully. The decline in Bessemer carried down with it the ordinary foundry and mill grades, as it had carried them up with its wonderful advance. Though the advance in common or non-Bessemer irons had not culminated at so high an altitude. An adjustment is rapidly going on and the equilibrium of the market will be soon established again. In the meantime the market is unsettled and sales are being made through separate and distinct negotiations, as as each important deal is presented. The Southern schedule of prices maintained so well since August has been virtually abrogated. The inflation of prices on non-Bessemer irons was not excessive and the reaction is therefore less severe on such producers. Many important transactions will mark the close of the year, as at prices obtainable for early and extended deliveries no serious loss is possible and large gains in value are altogether probable. Money is easy and collections continue very good.

Philadelphia. Unfortunately for the great iron world, the speculators who bought Bessemer iron and steel billets some four months ago, just as the "common herd" buy railway stock, by putting up a margin, have been compelled to unload during the quiet month of December. Hence we hear of some low sales of said speculative lots. The average furnace man is filling his old contracts and need not bother about new business until February or March. The present indications point to a heavy business during 1896.

St. Louis. The year closes with a dull market, and prices are temporarily demoralized. On Jan. 1, Connellsville coke advances 20 per cent of its present value, which will tend to further increase the cost of iron and steel products. All branches of foundry industry report a fair volume of business, and there is a hopeful feeling that the first quarter of the new year will lay the foundation of an improved condition of trade.

Bickford Drill & Tool Co., Cincinnati, manufacturer of radial and multiple drills, boring and turning mills writes:

We had a much finer business during the past year than in the two years previous, and especially in the latter half. Just now orders are somewhat quiet, but we only attribute this to the season of the year, as we find such to be the case generally at this time. We have a very large number of good things which we think will surely come about in a satisfactory manner, after the opening of the new year, and which will produce a satisfactory business result. During the past year we have brought out a fine line of special drilling machinery for bicycle plants, and have likewise perfected several new radial drills. In the coming year we hope to secure a complete new factory building and thus increase our facilities greatly.

A Central Western boiler manufacturer writes as follows:

I cannot see anything to prevent a constant improvement over and above what we have witnessed during the year 1895 but I do not know anything about it. I have been in the iron business all my life, and I am just as unable to tell whether business will be brisk or dull as I was unable to tell of the great revival in prices that we witnessed in 1895.

THE Chicago men who recently purchased the plant of the Muskegon Machine & Foundry Co., at Muskegon, Mich., have contracted to have 100 men at work early in 1896, in the malleable iron works they are to start and 300 or more by March 1. The year 1895 has given an impetus to the industrial life of Muskegon. The Amazon Knitting Co.'s plant, costing $100,000, is nearly completed. The main building, 220x80 feet, is five stories. The Loesher tannery, brought from Chicago, the Crescent Mfg. Co., from Detroit (now making 10,000 nail kegs a day), and the Spafford Mfg. Co., brought from Grand Rapids, manufacturing school and church seats and furniture, together with the Enterprise Foundry Co. have all been located the past year.

THE IRON TRADE REVIEW

DEVOTED TO
IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.
PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
CLEVELAND, OHIO.

CLEVELAND: 27 VINCENT STREET. A. I. FINDLEY, Editor.
CHICAGO: 1142 MONADNOCK BLOCK. B. M. GARDNER, Associate Editor and Western Manager.

ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASS MATTER

JANUARY 2, 1896.

OUR ANNIVERSARY NUMBER.

In our "Trade Revival Number" of one year ago a reason was given for marking the beginning of 1895 with a special issue. It was stated to be, not so much the belief that the country had entered upon a new period of prosperity in the old sense of that word, but rather because of the abundant evidences that 1895 would be a better year than either of the two that preceded it, and as an expression of the hope that before it ended the way out of industry's besetments would appear more clearly than was possible under conditions then existing.

The hope then expressed concerning 1895 was an unwitting prophecy. While the year closes under conditions sharply contrasting with those of August and September when the excitement of the boom was at its height, 1895 has been a profitable year for the iron and steel trade.

To-day's Anniversary Number of *The Iron Trade Review* is prompted in part by the exceptional character of the year whose results the iron trade is now summing up on its books, and in part by considerations more closely related to the interests of this paper. The year just closing has brought to *The Iron Trade Review* largely increased circulation and advertising patronage and greater prestige, and in these particulars has been an important one in the history of the paper. We do not elaborate upon these facts, because we understand that they are only of relative interest to our readers. But we cannot refer to them without accompanying recognition of the support that has come to our effort to represent fairly the interests of the foundry, machine shop, rolling mill, blast furnace, iron ore and allied industries, and particularly their splendid developments in the great Central district included between the Alleghenies and the Mississippi. The history of the American iron trade has been largely made in this Central Western zone in the past five years; the Central West promises, moreover, to be a maker of history in the years just ahead.

We can fairly promise that *The Iron Trade Review* will keep step with the progress of the important section with which it is most closely identified.

THE effort to forcast the demand for iron and steel in 1896 is natural; and while prophecy is not profitable, and those longest in the trade are chariest of expression, every operator is constantly making decisions that involve his opinion of the future. It will be agreed that 1896, from all indications to day, will not show any return of the prostration of 1893 and 1894. That the year will show a demand equal to that of 1895, without the violent fluctuatons in values marking the past year, is not improbable. The currency trouble of to-day was no less acute in 1895. The fact that the trade has been seeking for some weeks to find a price basis on which business can be done freely, after the natural reaction from the inflated prices of the summer, accounts for all that has happened to the market since October. It does not argue that the iron and steel needs of the country have shrunk. There are evidences that large requirements for Western railroads will come in the wake of the heavy crop movement. The structural needs of the country, that were an important element in the boom of last summer, may naturally be expected to expand, as cheap steel more and more displaces brick and stone and wood. Agricultural machinery manufacturers, as a leading representative of that industry says elsewhere in this issue, are counting on a considerably larger make in 1896 than in either of the two preceding years. It is plain that the iron-making capacity of the country, which, so to speak, was caught napping in the boom of 1895, is now in shape to take care of such a demand as that of last summer without the same sharp advance in prices. The boom was a calamity which fortunately is not likely to be repeated in 1896. Whatever prosperity comes to the iron trade in 1896 may be expected to come as the result of better conditions for industry in general, and not so much, as in 1895, from conditions within the trade itself.

A WORD OF CONGRATULATION.

NEW YORK, Dec. 5, 1895.

A. I. FINDLEY, ESQ., EDITOR THE IRON TRADE REVIEW, CLEVELAND, O.:

My Dear Mr. Editor: I congratulate *The Iron Trade Review* upon its anniversary, and upon its deserved success. Especially do I notice in its editorial articles a breadth of view and depth very unusual in trade journals. I think this its special feature, and no doubt much of its success is attributable to it. After all, a sound original editorial is the great feature of a newspaper. I place it before even what passes as news.

Very truly yours,

ANDREW CARNEGIE.

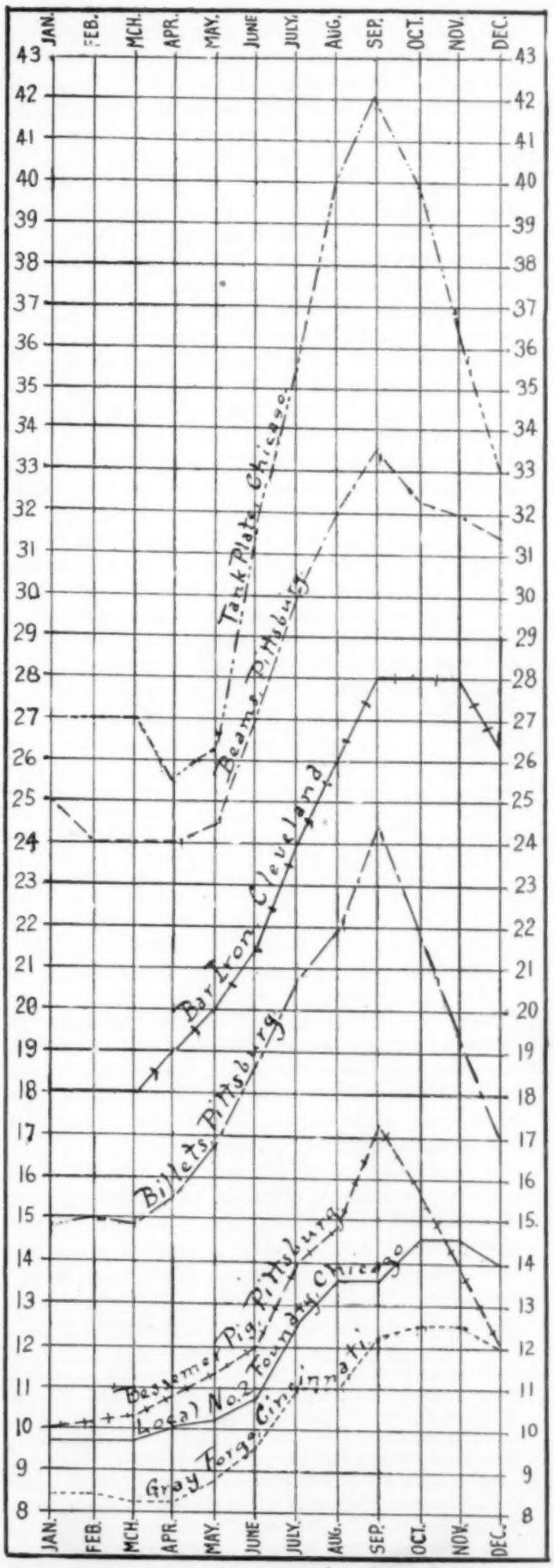
Mahoning Furnacemen and Mill Owners.

On page 12 we present a group in which appear the following representatives of the iron industries of the Mahoning Valley:

Edward L. Ford, superintendent Youngstown Steel Co.; J. M. Thomas, secretary and treasurer Thomas Furnace Co., Niles, O.; C. D. Arms, president Mahoning Valley Iron Co.; W. Scott Bonnell, vice-president Mahoning Valley Iron Co.; Thos. H. Wells, president Ohio Iron & Steel Co., Lowellville, O.; E. P. Williams, secretary Brown-Bonnell Iron Co.; W. E. Taylor, second vice-president and treasurer Union Iron & Steel Co.; Samuel Mather, Cleveland, president Brown-Bonnell Iron Co.; Henry Wick, president Ohio Steel Co.; Geo. Tod, president Brier Hill Iron & Coal Co.; J. R. Thomas, president Thomas Furnace Co., Niles, O.; Wm. H. Baldwin, secretary Ohio Steel Co.; Tod Ford, president and general manager Youngstown Steel Co.; John I. Williams, general manager Brown-Bonnell Iron Co.; James L. Botsford, secretary and treasurer Mahoning Valley Iron Co.; Robert Bentley, secretary and general manager Ohio Iron & Steel Co., Lowellville, O.; L. E. Cochran, president and general manager Andrews Bros. Co.; Jno. F. Taylor, treasurer Brown-Bonnell Iron Co.; Geo. D. Wick, first vice-president Union Iron & Steel Co.; J. G. Butler, Jr., general manager Brier Hill Iron & Coal Co.

PRICE FLUCTUATIONS IN 1895.

The record of iron and steel prices for 1895 is an attractive field for the graphic method. From May into



September the course of the plotted lines standing for various classes of material is almost uninterruptedly upward, and from September to the end of the year there is a uniformly downward dip—except on products held up by agreements. The eye thus takes in at a glance the story of a wonderful year, a year of an unwelcome and unfortunate boom and the inevitable reaction.

For the accompanying chart three kinds of pig iron, three classes of finished material, and steel billets, have been selected as typical of the price movements of the year in iron and steel. The vertical lines are month lines and the horizontal lines price lines. The course through the spaces, of the heavy lines representing various materials, is not significant, but only their intersections with vertical or horizontal lines. The monthly price was obtained in all cases by taking the average of prices given in weekly market reports of sales. In the case of finished material the record is given in the net ton basis of the market. The three lines for bar iron, tank steel, and beams are thus in proper relation to each other, though not to the other four lines which represent material sold in gross tons.

It will be noted that the chart does not show the extreme of the year's fluctuations, as prices may have been higher or lower in a given month than the average. The following table, showing the prices at the opening and closing of the year, also the lowest and the highest prices in the year, of the materials named, will be found of interest:

	Jan. 1, 1895.	Lowest Price, 1895.	Highest Price, 1895.	Dec. 31, 1895.
Local No. 2 Foundry, Chicago...	$ 9.75	$ 9.50	$14.50	$14.00
Gray Forge, Cincinnati.....	$ 8.50	$ 8.00	$12.50	$11.75
Tank Plate, Chicago.....	1.35c	1.25c	2.10c	1.60c
Billets, Pittsburg.....	$14.85	$14.75	$24.75	$16.25
Beams, Pittsburg.....	1.20c	1.20c	1.70c	1.50c
Bessemer Pig, Pittsburg.....	$ 9.85	$ 9.85	$17.40	$10.75
Bar Iron, Cleveland.....	.90c	.85c	1.40c	1.25c

The following table shows the average monthly prices per ton, at the points named, of the products represented in the chart:

AVERAGE PRICES ON CERTAIN IRON AND STEEL PRODUCTS EACH MONTH IN 1895.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Local No. 2 Fdy., Chicago	9.75	9.75	9.75	10.	10.25	10.75	12.50	13.50	13.50	14.50	14.50	14.
Gray Forge, Cincinnati.....	8.50	8.50	8.25	8.25	8.75	9.50	11.	11.	12.25	12.50	12.50	12.
Tank Plate, Chi., net ton..	27.	27.	27.	25.50	26.25	31.50	35.50	40.	42.	40.	36.50	33.
Billets, Pittsburg.....	14.85	15.	14.85	15.40	16.75	18.75	20.85	22.	24.25	22.	19.50	17.
Beams, Pittsburg, net ton	25.	24.	24.	24.	24.50	27.	30.	32.	33.50	32.50	32.	31.
Bessemer, Pittsburg	10.	10.15	10.25	10.75	11.25	12.	14.	14.75	17.25	15.75	14.	12.25
Bar Iron, Cleveland, net ton..	18.	18.	18.	19.	20.	21.50	24.	26.	28.	28.	28.	26.50

Other fluctuations of the year are represented by 85c and $2.25 for wire nails; $20.50 and $31.50 for wire rods at Pittsburg; 2.15c and 2.75c Pittsburg, for No. 27 common black sheets; and by 1c and 2c, Pittsburg, for tank steel. The highest price of the year on Bessemer pig was reached in the week of Sept. 5, and in the same week billets were at their highest point. The period between Sept. 1 and Sept. 10 may fairly be spoken of as the height of the boom.

WE have had all the work we possibly could do the past year, and are filled up with orders to our utmost capacity. There will be no question that we will do twice the amount of work in the future and with this expectation, we have leased a lot 90x200 on which place we intend to erect a modern structure entirely of brick and iron. It will be exactly like the Link Belt Machinery Co.'s building in Chicago. We have made during this year a new improved 18" lathe and have just completed patterns for a 26" lathe. We will have drawings and patterns ready within the next 30 days for a full line of automatic screw machines. We also have in view a 30", 36" and 40" inch lathe which will enable us to furnish complete outfits.—[Deitz, Schumahcer & Co.

THE CHICAGO IRON MARKET IN 1895.

The past year has been a most remarkable one in many respects and in several instances records were broken. At the beginning of 1895 iron values were low, the business in hand was small and that in prospect was scarcely more promising, all of which induced a feeling not particularly hopeful among dealers and manufacturers. The year 1894 had been very dull and its losses by failures, strikes, and receding values had been large. Iron and steel manufacturers generally had come to entertain the most conservative views as to the future.

The first few months of 1895 did not show a particularly large business, but a more hopeful feeling gradually took the place of the lack of confidence among both buyers and sellers of iron and steel products, and sales began to increase in number and in volume. Prices began to advance in April and they continued to rise until October, with occasionally a slight reaction, which in nearly every case was followed by quick recovery. With the advance in coke, the quickened demand for building material and the placing of moderate car orders, buyers began to realize that there were prospects for an expanding market for all products and that the probabilities were for higher values. As a result of this belief orders became more plentiful.

Some trouble was experienced in May from strikes, caused by dissatisfied laborers at the South Works and Joliet Works of the Illinois Steel Co. At the South Works the strike lasted only a few days, but at the Joliet Works it continued for nearly two weeks, causing considerable delay in shipments of pig iron and billets and not a little embarrassment to users of the latter, particularly tin plate manufacturers, a number of whom expected to have to shut down. Such action, however, proved not to be necessary.

The market commenced to take on the aspect of a boom the latter part of June, advancing values and largely increasing sales being reported every week. It was apparent that the increase in demand was caused almost entirely by increased needs on the part of consumers, and not by any speculative dealing in material. Later developments show that there was large speculative buying of billets and Bessemer pig in the Central West, but very much the larger part of the buying throughout the year in these, as in other products, was by consumers for their actual needs and not for speculation. Prices advanced very rapidly in June, and for the next three months a rise was noted in the market reports on some class of material every week. During July and August crude material was quiet and the sales were smaller than in the months immediately preceding. The furnaces welcomed this change, however, as they had been very heavily oversold and the slackening in buying gave them an opportunity to gain on their contracts.

Buying of billets, rods and sheet bars was very heavy in July and August and quotations advanced from $22.50 on July 1 to $25 in September on billets and proportionately on rods and bars, with considerable fluctuation between those dates. A number of large orders for structural material were also given out in the summer months and quotations were advanced $4 to $5 a ton. The Calumet furnace went into blast on Sept. 15 and ran until Dec. 1 on foundry iron, turning on to Bessemer then to fill a contract of 15,000 tons for the local steel company.

There was a halt in buying about Sept. 1 and the market generally was a declining one from then until the end of the year, though quotations on pig iron and on some forms of finished material were maintained through November. In some branches—notably bars and structural material—trade continued good until almost the end of the year. The Merchant Bar Iron Association, which was formed early in 1895, displayed its strength by maintaining prices on bar iron in the declining market until almost the end of the year. The association found it necessary to reduce the price of bar iron to meet the lower values of other material, the middle of December, and quotations were cut from 1.50c to 1.35c Chicago. Beginning in September, orders for cars from Western railroads and transportation companies were large, and the car works received sufficient business to employ them throughout the balance of the year and well into 1896. This created a demand for bar iron and other classes of material. A surprise was sprung upon the market the first part of December, by the placing of orders for fourteen vessels with lake shipbuilders by Mesabi ore interests, creating a very large demand for plates, angles and other material required for their construction. Much of this business was taken by the Chicago district.

The summer and early fall saw a large amount of speculation in Eastern markets and this had considerable to do with the low values which followed. In the Chicago market, however, very little speculation was indulged. The feeling generally among manufacturers of iron and steel products at the end of the year is that buying will commence again, and be of good proportions shortly after the first of 1896, and consumers of iron and steel share in this feeling of confidence to a great extent.

The range of values in the Chicago market in the past year is shown by the following table of prices:

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Lake Sup. Charcoal..	13.	13.	13.	13.	13.	13.	13.25	13.50	14.50	15.50	15.50	15.50
Northern No. 2 Fdry.	9.75	9.75	9.75	9.75	10.25	10.25	11.50	13.	13.50	14.50	14.50	14.
Southern No. 2 Fdry.	10.25	10.	10.	10.	10.50	10.25	12.50	12.25	13.25	13.85	13.85	13.85
Bars	1.05	1.	1.	1.	1.10	1.15	1.30	1.30	1.50	1.50	1.50	1.59
Rails	23.	23.	23.	23.	23.	23.	25.	25.	25.	29.	29.	29.
Beams	1.45	1.45	1.45	1.45	1.45	1.50	1.70	1.80	1.90	1.90	1.90	1.90
Tank plates	1.40	1.40	1.35	1.30	1.30	1.45	1.70	1.90	2.10	2.	1.90	1.75
Billets	17.	16.50	16.50	16.50	17.50	20.	22.50	23.50	25.	26.	24.	22.
Sheets No. 27	2.35	2.30	2.30	2.25	2.25	2.40	2.60	2.80	2.85	2.95	2.75	2.55

The future is too uncertain for prophecy, but the indications seem to point to a demand for 1896 that will be at least as large as that of 1895. It is evident that freight carriers think their business will be very large in the coming year. It is expected that Western rail and car buying will be of good proportions the first part of 1896—this, in addition to the fact that lake carriers have increased their available tonnage to a large extent the past year, and will increase it still further in 1896. The iron mining interests have also made preparations to ship very large quantities of ore next season, of which preparations the vessels ordered are only a part. Dock facilities at the head of the lakes are being materially increased.

ENTIRELY successful tests have just been made at Alexandria, Ind., of the water works pumping plant installed by the Stillwell-Bierce & Smith-Vaile Co., of Dayton, O. The engines are of the cross-compound, non-condensing duplex type, each having a capacity of 2,000,000 gallons in 24 hours. The steam plant is equipped with the improved Stilwell heater, filter and lime extractor, which delivers pure water to the boilers at boiling temperature. The water works machinery of the Dayton company is now in use in 300 cities and towns.

AT Springfield, O., C. H. Pierce has been appointed receiver of Armstrong Bros., boiler makers.

MACHINERY TRADE IN 1895.

Foundries paid high prices for their iron the past year, compared with the average cost in the two preceding years. While some of them were fortunate enough to have pig iron contracts running through a considerable portion of the boom period, and based on prices of the early months of the year, there were few who did not buy larger or smaller quantities of iron after the advances had been well established. They did not, in turn, obtain a corresponding advance on castings; in some lines there was scarcely any increase. The year, while it brought a larger demand to the doors of the machine shops and foundries, did not prove generally profitable to them. The opinions given below are in response to an inquiry from *The Iron Trade Review*, as to the extent to which machinery men and founders, construction firms and makers of all forms of power equipment, who have the iron industry as one of their dependencies, had participated in the heavy demand which the year brought to iron and steel manufacturers:

Berlin Iron Bridge Co., East Berlin, Conn., engineers and builders of iron and steel bridges, buildings, etc.:

Our business the first half of 1895 was about as poor as it could well be. During the latter half of 1895 we have noted a very great improvement. We cannot ask for any better business than we have had during the latter half of the present year. For the past year and a half we have taken advantage of the very low prices of all classes of tools and machinery, and added very materially to our equipment. In the past six months our production has averaged about 1,500 tons per month, where formerly it was 900 tons. Notwithstanding this great increase in our productive capacity, we have found it hard work to keep up with our orders during the latter half of the year. For 1896 we notice a great improvement. The year opens with more confidence and more ability on the part of the people to pay. We also believe that the large production of gold in South Africa and in our own western states will be an important element in the business of the future, adding very materially to the wealth of the world, as well as to the wealth of this country, and consequently increasing the valuation of product. We have no hesitation in saying that we approach the business of 1896, with feelings of perfect confidence.

Cady Manufacturing Co., Cleveland, power presses and special machinery:

Our trade for the last three months has been very satisfactory, although we find some difficulty in making our prices keep pace with the general advance in labor and material. From the inquiries for machinery now before us, we confidently expect that we will have a good trade for the six months to come.

Moore Mfg. & Foundry Co., Milwaukee, Wis., manufacturers of anti-friction differential pulley blocks, gray iron castings and hardware specialties:

Our business for 1895 shows an advance of 15% over that of '94, and while it is now very dull, as usual at this season, we are looking forward to a healthy business in '96, a good deal depending upon wise action or a disposition to wise action in Washington.

Enterprise Boiler Co., Youngstown, O., manufacturers of boilers, blast furnaces, steel stacks, tanks and heavy plate work:

Our business is principally in constructing and remodeling blast furnaces and work in this line. We have been very busy since the revival of the iron trade last spring, although prices have not advanced in proportion to those of raw material and labor, nor what would be naturally expected from the increased demand. Just now there is a lull in placing contracts, but inquiries keep up and we believe that unless some disturbing element creeps in, there will be a large volume of business in our line after the first of the year.

Inquiries come from so many parts of the country that we are convinced that the feeling among manufacturers in general is that the prospect of business in the near future is good, and that it behooves them to have their plants in shape to take care of it. We anticipate a large year's business for 1896 and we believe our anticipations are based on good grounds.

The Connersville Blower Co., Connersville, Ind., manufacturers of blowers, gas exhausters and pumps:

Our trade this year has increased very gratifyingly, our books showing that we have done 50% more business than in 1894. Prices, however, have not grown any better; indeed, the margin of profit is narrower than during the late depression. As to 1896, we do not care to venture a prophecy, as there are some features to be taken into consideration, the full effect of which cannot now be determined. We are hopeful, nevertheless, that the worst has been past and that a season of prosperity is at hand.

Jeffrey Mfg. Co., Columbus, O., manufacturers of mining, elevating and conveying machinery:

We cannot see from our standpoint any reason why the year '96 should not be a decidedly good year for all builders of tools, machinery and general power equipment. There has been, for the past two or three years, a tendency on the part of consumers of machinery and power plants, to reduce the expense of their several plants, but the limit has been reached and we suppose they will have to follow the same course that we as manufacturers have found it necessary to; that is, replenish stocks and purchase new machinery, which we had deferred buying for signs of better times.

Aurora Tool Works, Aurora, Ind., manufacturers of radial drills and other tools:

Early in the spring there was quite a revival in our line of business, which increased until about mid-summer when a reaction took place and at the present time it is very little better than it was at this time last year. Our trade in the early part of the season was almost entirely in the East. We find now very little demand from the East and that Chicago is at present our best market. We owe a large portion of our increase to the demand from bicycle manufacturers. We are not very hopeful for the incoming year, as we think there will be no settlement of either the tariff or the financial question, both of which are of the utmost importance to the manufacturer.

E. W. Bliss Co., Brooklyn, manufacturers of power presses and other metal working machinery:

Our business is fully 50 per cent better than it was a year ago. Manufacturers who use our machinery seem to be pushing out, probably in large measure to meet demand naturally consequent upon reduction to an extremely low point, of all jobbers', wholesalers' and retailers' stocks. Business is very satisfactory and the outlook for '96 promising. We are making much machinery for bicycle manufacturers.

J. E. Rhoads & Sons, Wilmington, Del., leather belting:

Our business has been very much larger than last season. Our sales up to the first of December increased at the rate of 50% over last year. This was perhaps one-tenth of it due to higher prices.

The Q. & C. Co., Chicago, manufacturers of railway supplies, metal saws and other special machinery:

It is with great pleasure we report to you a very large increase in our business for the year 1895, and from the inquiries in hand we have every reason to look for a still greater increase for the coming year.

Shiffler Bridge Co., Pittsburg, bridge and structural builders:

Our experience during the present year has been far from satisfactory, notwithstanding we have done a large amount of business, which being done under pressure was done at a great deal of disadvantage. We hope the business of 1896 will prove more satisfactory, even if not in so great a volume.

Keasbey & Mattison Co., Ambler, Pa., steam pipe and boiler covering:

The prospects for business in 1896, we would say, are very brilliant, and persons engaged in the trades that are allied to

the iron industry, or furnishing supplies to those engaged in this industry will probably have the best year's business that they have ever had, fully equal to 1893, if they do not surpass it in the volume of their transactions. We do not doubt that the profits in all lines will be decidedly less than in the year before the panic, but we believe the increased volume of business will make up, in a large measure, for this deficiency in most lines of the business.

Vulcan Iron Works Co., Toledo, O., manufacturers of steam shovels, boiler fronts, etc. :

We think the machinery and foundry business generally has been much improved over last year, and as far as we are concerned everything looks favorable for a largely increased trade the coming year. This is certainly the case in the steam shovel line. We have more inquiries at present, and more favorable prospects for sales than for two years past.

Lane & Bodley Co., Cincinnati, manufacturers of Corliss engines, sawmills, elevators, etc. :

The last six months of this year have certainly brought us a very greatly increased volume of business, but we believe it to be due to the effort of buyers to take advantage of the low prices, and the competition for the trade has been such as to prevent engine builders at least from getting any advantage from the increased price of iron. We have a very hopeful outlook for 1896 so far as the volume of business is concerned, but unless manufacturers can agree on getting a reasonable compensation for their labor the results may not be as profitable as they should be.

Bullard Machine Tool Co., Bridgeport, Conn. :

We experienced, beginning with May 1st, a very gratifying increase of our business and the indications for its continuance are favorable.

Stilwell-Bierce & Smith-Vaile Co., Dayton, O., manufacturers of hydraulic machinery, Victor turbines, feed water heaters and purifiers, etc. :

We have not been able to share in the revival of trade to any extent. Notwithstanding the increased cost of iron, we have not been able to obtain any material advance in the price of our goods, and while the volume of business has been quickened, the profits continue small. However, we have no reason to complain. We have been favored with a fair amount of work at prices that have enabled us to make our regular dividends and the outlook for the coming year we regard as very favorable. Present indications are that we shall have all that we will be able to do.

Buffalo Forge Co., Buffalo, N. Y., manufacturers of hot blast apparatus, cupola and forge blowers, forges, engine, blacksmith tools, etc. :

The revival in our particular branch of the iron trade is undoubtedly as satisfactory as in other fields. We have been compelled not only to increase materially our force to keep pace with orders, but to run over-time. Notwithstanding the recent large additional buildings provided, we are forced to erect another large structure the forthcoming spring. We look for continued prosperity, and in the event of a change in administration, believe from 1897 on, that we may look for greater prosperity than hitherto known.

Illinois Screw Co., Chicago, makers of machine screws, etc. :

Our trade has been fitful, but on the whole an increase of 50% over 1894. We are in doubt about 1896, but incline to the belief that there will be some improvement over 1895.

Hill, Clarke & Co., Boston, iron and brass working machinery :

Although the iron trade has been very brisk this year, and business with the foundries has been unusually good, the same cannot be said of the general machinery business. Manufacturers of machine tools would have had a very quiet year except for the demand for the lighter kinds of machinery from bicycle manufacturers. The manufacturers of screw machines, small lathes, upright drills and special machines used by bicycle manufacturers have been exceedingly busy, but manufacturers of heavy machine tools, large lathes, boring mills, etc., have found business rather quiet. We feel quite sure, unless all signs fail, that we shall have more active business in the general lines in 1896. There is only one stumbling block in our way, now, and that is the currency question. As soon as that is settled right we will certainly have another period of great prosperity.

Cincinnati Milling Machine Co., Cincinnati, manufacturers of milling machines and cutter and reamer grinders :

Largely owing to the bicycle trade, the year 1895 proved to be the best in the history of our business. It is difficult just now to predict the outcome for 1896, but we hope, through the general improvement in other lines, resulting in an increased demand there, to do as large a business in '96 as we have done in '95. Building on this hope, we have very largely increased our facilities.

Fox Machine Co., Grand Rapids, Mich., manufacturers of wood-working and iron-working machinery :

It is possible that the statement that we may have to make regarding business will not be a fair index of business in general, from the fact that we have engaged for the past year in the manufacture of tools which enter into the manufacture of bicycles. Our business for 1895 has been very satisfactory. There has been no time since the opening up of the season that we have been able to accumulate a stock of any of our special tools for bicycle work. But outside of this and outside of the demand which has come from manufacturers building bicycle machinery, we can see there has been very little improvement. We are looking for a better trade in '96 in general lines, but do not look for any increase in price of raw material.

Buckeye Mfg. Co., Anderson, Ind., manufacturers of gasoline engines, hardware specialties, etc.

Our machinery department is crowded to its utmost with business, and the prospects for a good spring trade are unparalleled. Our gas engine trade has exceeded very much our expectations and we are loaded up with orders at this time.

Chas. H. Besly & Co., Chicago, fine tools, manufacturers' and machinists' hardware, etc.

Helmet bronze for springs, Helmet babbitt for bearings, Gardner grinders for grinding flat surfaces, all of which we manufacture, have sold better in 1895 than ever before and the advertisement in your journal has helped us do it. Our trade is in good condition, and we expect even better trade in 1896.

J. Wendell Cole, Columbus and Chicago, district manager for Detroit Emery Wheel Co. :

The fall trade of 1895 was quite an improvement upon 1894, in fact, the best since 1892. I think, however, that the iron and steel manufacturers raised price too rapidly, forgetting that the revival of trade was mostly in building and induced by low prices, in spite of the stagnation caused by the Wilson bill, and the forced depression of silver by adverse legislation in Europe and the United States. The farmers are getting too low prices for their crops for any boom to arrive, until a protective tariff turns the gold current towards American shores again, which will probably be about September 1, 1897.

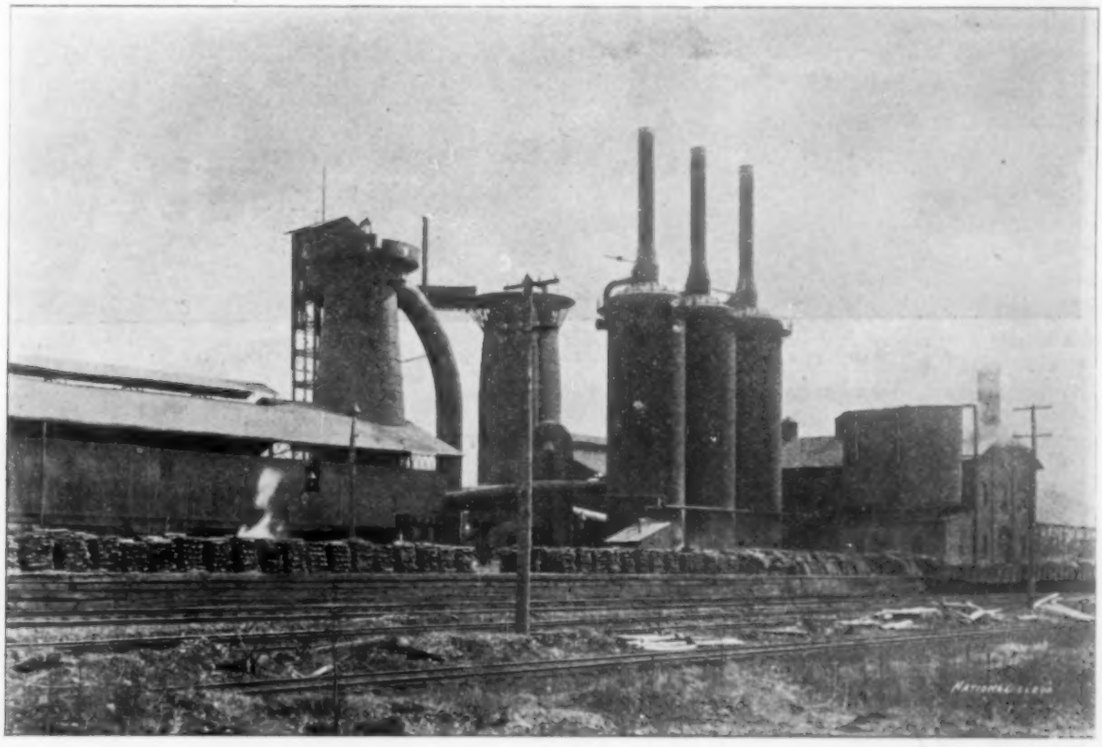
S. Freeman & Sons' Mfg. Co., Racine, Wis., manufacturers of boilers and of agricultural implements :

We have participated in the improved demand for products in our line during the past season. About a year ago we anticipated an improvement in the iron business and built a new boiler shop, one of the largest in the West, and equipped it with the very best class of machinery. To say that our expectations were fully realized but mildly expresses it, our boiler shop being crowded with work all through the season. The prospects for trade in 1896 are most excellent. We have already contracted for enough work to keep one-half of the shop busy until September next, and we believe that we will have no trouble in securing, from time to time, enough to keep the balance of the shop working full time. We have recently added to our plant a new hydraulic flanging machine sufficiently large to flange boiler heads to 84″ in diameter. We are also erecting a brick addition to our boiler shop, 50x115 feet, which will be used exclusively as a flanging and sheet iron department.

IRON WORKS OF THE MAHONING VALLEY.

The concentration of the Bessemer pig iron production of the country upon the Central West, in the past two years, has made the campaign of blast furnace improvement in that section a particularly active one. The study has been to get larger outputs, to decrease cost, and to command every facility for the most efficient operation. Merchant furnaces in the districts nearest to Lake Erie docks, whence their ores directly come, have had larger duty put upon them by the starting, in the past year, of two large steel plants in Ohio, which together have attained a daily consumption of more than 2,000 tons of Bessemer pig metal. It can be appreciated, then, that the modernizing of furnace plants has had more attention in the valleys, in 1894 and 1895, than in any other two years in their history.

This fact, more than any other, is emphasized by a visit to Mahoning Valley plants, concerning which some memoranda are brought together in the present article. No effort is made to present a description of the various furnace and rolling mill plants of this important iron and steel making center, but rather to note briefly some of the improvements that have been made in the readjustment of costs compelled by the depression of 1893 and 1894.



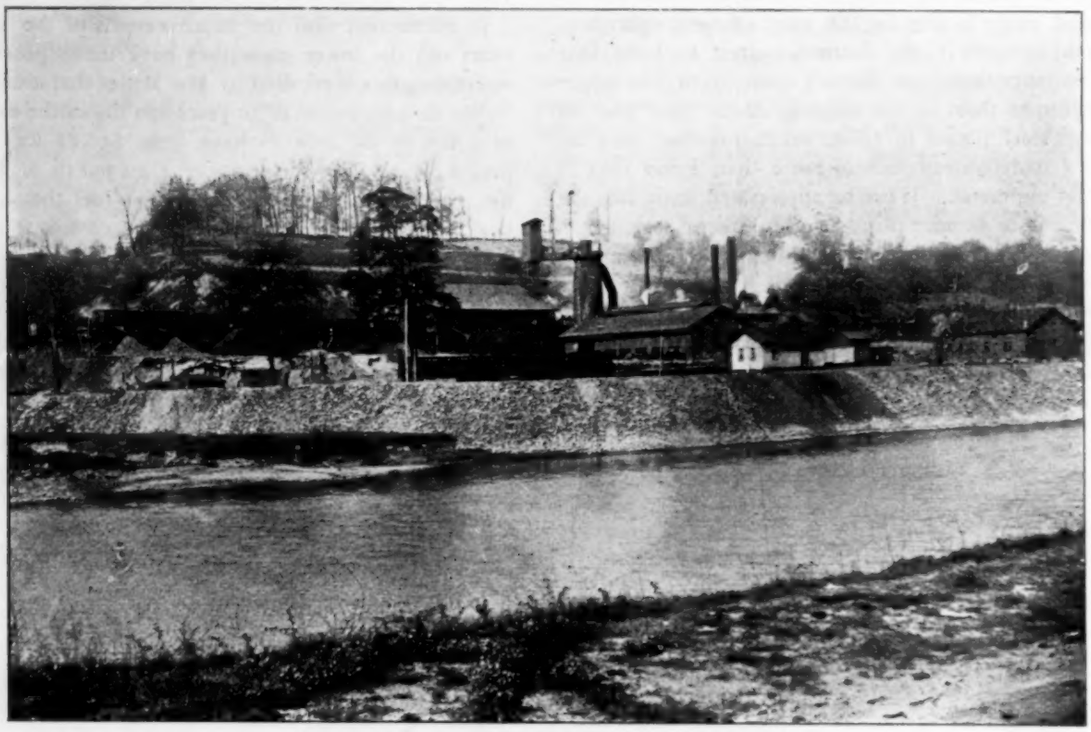
GRACE FURNACE OF THE BRIER HILL IRON AND COAL CO., YOUNGSTOWN, O.—LARGEST IN THE MAHONING VALLEY.

In the Mahoning Valley proper, extending from a point near Leavittsburg to the mouth of the Mahoning river, near Lawrence Junction, a distance of 37 miles, are 12 blast furnaces, 12 rolling mills and one steel plant. The new works operated for the first in the year just closing are the steel mill of the Ohio Steel Co., at Youngstown, and the tin plate mill of the Falcon Tin Plate & Sheet Co., at Niles. A tonnage statement for the year, showing shipments of both raw material and product to and from the furnaces and mills, would be interesting, but the figures will not be collected for another month or two. In some statistical matter relative to the valley's iron industries prepared by Mr. J. G. Butler, Jr., last year, it was estimated that the daily output of the furnaces was 2,500 tons, and of the mills 2,000 tons, not counting the steel plant, which has now attained a daily output of from 800 to 1,000 tons. From 1,952,576 tons in 1880, the raw material and product of Mahoning Valley iron works increased to 2,465,400 tons in 1888. In 1892 it was 4,000,000 tons, and with plants operated fairly up to their capacity in 1896 ought to reach 5,500,000 tons.

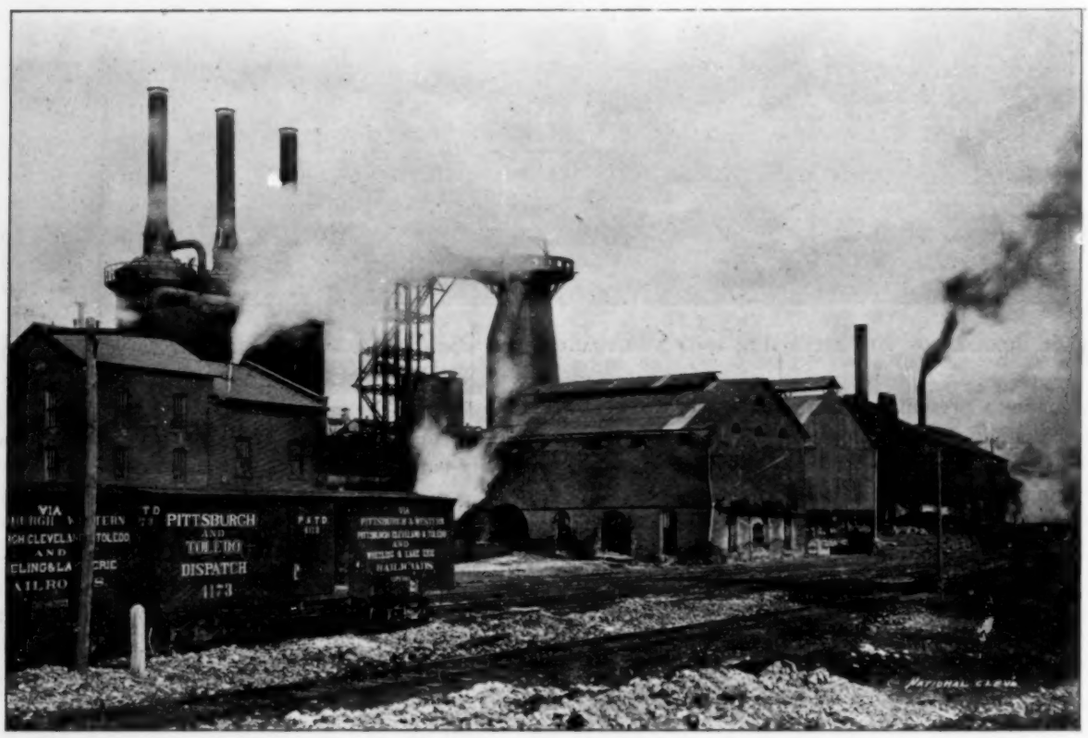
In connection with the improvements of the past two years and the lower costs they have made possible, the interesting fact is recalled by Mr. Butler that a Mahoning Valley furnace report of 30 years ago shows the exact cost of a ton of pig iron to have been $50.81 for a stated period. The Lake Superior ore, then put in at $15.50 a ton, sold the past year at $2.50. The fuel then used was coal, at $10 a ton, and the limestone cost four times as much as to-day, making the total about five times the cost of a ton of pig iron to-day. Similarly bar iron, that sold below 90 cents per 100 lbs. at valley mill early in 1895, has brought six cents a pound in the memory of the present generation of valley mill owners. The productive capacity of the mills has been much increased. A train of rolls that produced 30 tons a day in 1865, now gives a daily output of 70 tons.

Several developments of interest are noted in connection with Mahoning Valley industries the past year, in addition to the starting of its first Bessemer steel plant, and the beginning of the manufacture of tin plate on a large scale. Two 1,000 ton shipments were made to England for armor plate purposes, of the "washed metal" that is peculiarly a Mahoning Valley product. These shipments mark the beginning of its export. The Bethlehem Iron Co. has used this metal for several years, and will use it in the Russian armor plate contract now being executed at Bethlehem. The year 1895 showed the effect of a sectional tariff provision in a marked falling off in the product of cotton ties from the Mahoning Valley, this district heretofore having furnished one-half the bales for the cotton crop of the South. The custom house records show that British mills and British labor got the benefit of

the change. The past year was marked also by the death of the father of American-Scotch pig iron manufacture in the Mahoning Valley—Jonathan Warner, who first utilized native black band ores in a furnace at Mineral Ridge. Hubbard, Lowellville, Haselton and Brier Hill, all produce American-Scotch to day, and black band ores have been replaced by Lake Superior mixtures quite their equal.



MARY FURNACE OF THE OHIO IRON AND STEEL CO., LOWELLVILLE, O.

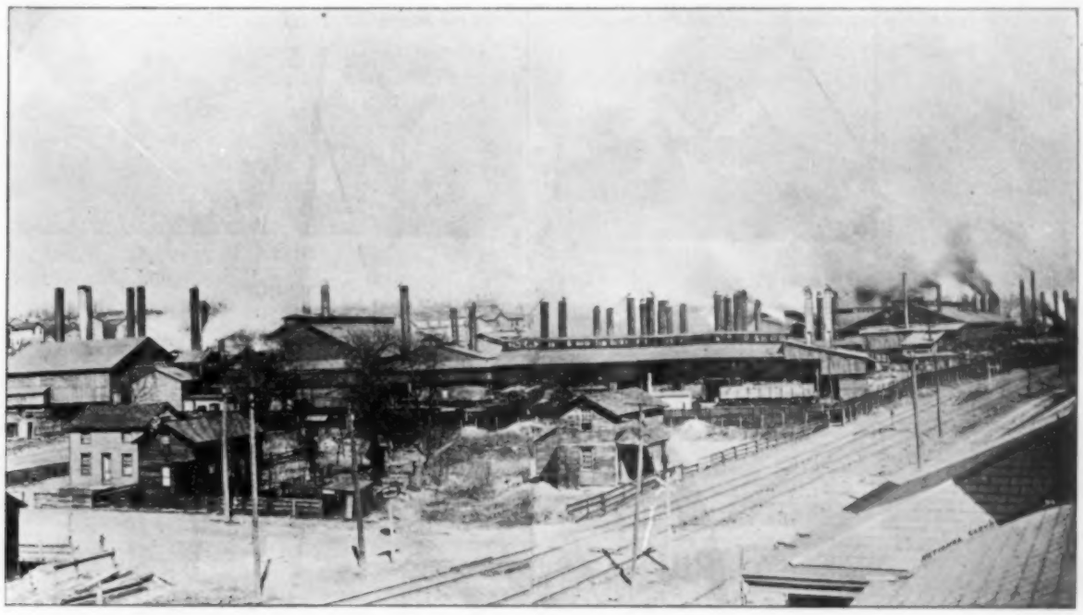


TWO FURNACES OF THE YOUNGSTOWN STEEL CO., YOUNGSTOWN, O.

Blast Furnace Betterments.

Scarcely a furnace of the 12 in the Mahoning Valley proper has gone through the past 18 months without radical changes tending to increase output. Similar work has been done in that period also, at the Seneca and Cherry Valley plants, which are classified with Mahoning furnaces, though not strictly speaking in the Valley. Grace Furnaces Nos. 1 and 2, the largest furnace plant in the Valley, and of which a view is given in one of the annexed illustrations, have been relined and repaired in the interval mentioned, as has also their neighbor, the Tod Furnace, of the Youngstown Steel Co. The Grace Furnaces, Nos. 1 and 2, are respectively 80x18 feet and 77x18¾ feet. Their total rated annual capacity is 100,000

gross tons. They have been on Bessemer iron, and in the past year have had a large output. Tod Furnace has made Bessemer iron for the past year, and part of its output has passed to the dephospnorizing plant of the Youngstown Steel Co., where the Krupp-Bell process is employed, with important modifications and improvements.



LOWER MILL OF THE UNION IRON AND STEEL CO., YOUNGSTOWN, O.

At Mary Furnace, of the Ohio Iron and Steel Co., at Lowellville, O., the improvements made in 1894 consisted in installing three Cowper-Kennedy stoves, 19x75, remodeling all the gas flues and boilers, an increase in the size of the bosh lines, a new hoisting engine and improvements to the blowing engines, the remodeling of tracks, giving nearly a mile of dock room and sidings. This general overhauling of the property insured a larger output of the well known "Mary" and "Mary Ohio Scotch" irons, and made possible a more perfect control of the silicons. For a portion of the past year, under the prices that attracted so large a capacity of Central Western furnace to that metal, Mary Furnace has been on Bessemer.

Mattie Furnace, at Girard, which is 80x18, equal to the larger Grace Furnace at Brier Hill, was rebuilt in 1892, and is now about to undergo a second complete overhauling. Three brick stoves of the Foote type are now being erected, and it is the plan to put in more boiler power and later add a new blowing engine and appliances for washing gas. When this is done the furnace will be rebuilt from the bottom up.

HASELTON IRON WORKS OF THE ANDREWS BROS. CO., YOUNGSTOWN, O.

REPRESENTATIVE BLAST FURNACEMEN AND MILL OWNERS OF THE MAHONING VALLEY.

1, EDWARD L. FORD. 2, J. M. THOMAS. 3, C. D. ARMS. 4, W. SCOTT BONNELL. 5, THOS. H. WELLS. 6. E. P. WILLIAMS. 7, W. E. TAYLOR. 8, SAMUEL MATHER. 9, HENRY WICK. 10, GEO. TOD. 11, J. R. THOMAS. 12, WM. H. BALDWIN. 13, TOD FORD. 14, JNO. I. WILLIAMS. 15, JAMES L. BOTSFORD. 16, ROBT. BENTLEY. 17, L. E. COCHRAN. 18, JNO. F. TAYLOR. 19, GEO. D. WICK. 20, J. G. BUTLER, JR.

Large expenditures have been made on the Andrews & Hitchcock Iron Co.'s furnace plant at Hubbard, the past year. The company is now running two furnaces, one on Bessemer and one on foundry iron, and has been shipping its product as fast as made, leaving a clean yard at the opening of the new year. The improvements of the year include the entire rebuilding of one stack. Recently work has been in progress on a fourth stove, so that three will be constantly effective. The well known foundry irons of the company are Hubbard strong and Hubbard Scotch.

At the Haselton Iron Works of the Andrews Bros. Co., the principal improvement of the past year has been the erection of a 65′ x 16′ standpipe, giving the blast furnace and the adjoining rolling mills much better water facilities and guaranteeing a supply beyond immediate future needs. The pumping station equipment consists of one Blake and two Epping-Carpenter pumps, and smaller pumps are located at various points in the mill and furnace plants. The Andrews Bros. Co. has ordered from the E. P. Allis Co., Milwaukee, two vertical blowing engines, one to be delivered in January and the other April 1. The steam cylinders are 42″ x 60″, and the air cylinders 84″ x 60″. These engines are specially heavy, the fly wheels weighing 25 tons each. The steam cylinders are fitted with Reynolds-Corliss gear, giving the best possible steam economy. The air cylinders are fitted with Kennedy patent piston inlet valves and large mechanically operated poppet discharge valves. A blowing pressure of 25 pounds per square inch, with 50 revolutions per minute is guaranteed. The Haselton furnace has been on Bessemer a considerable portion of the past year. Arrangements are made to turn on to foundry iron early in the new year.

At its Hannah Furnace, the Mahoning Valley Iron Co. of Youngstown, installed a new vertical blowing engine last spring. It is of the Weimer type, the steam cylinder having a diameter of 42″, and the blowing cylinder having a diameter of 84″, both 48″ stroke. A regular speed of 50 revolutions per minute is maintained. The company has recently added a fourth stove of the Massick-Crooke design, which was built by McClure & Son, of Pittsburg. The furnace has a capacity of 65,000 tons a year and ordinarily runs on mill iron, though Bessemer has been made a portion of the time the past year.

Anna Furnace, of the Brown-Bonnell Iron Co., has been rebuilt the past year and new stoves and Cuyahoga blowing engines have been built for the company. On May 1 it passes into the hands of Runyon, Stubbs & Co., of Cleveland. Phœnix Furnace of this company has run on mill iron. It is the expectation that a new and thoroughly modern furnace will be built by this company adjoining its rolling mill plant, but details are not fully determined.

Thomas Furnace at Niles, with its 76 x 17 stack and four stoves, has been making a very large output. It was entirely rebuilt in 1890 and a number of improvements were made two years ago that added much to its efficiency.

Rolling Mills of the Valley.

The good reputation of Mahoning Valley bar iron and rolling mill specialties has been fully maintained in the past year, and between April and November all the valley mills worked full in nearly every department. Cold rolled shafting, railroad splice bars, coupling pins, cotton ties and horse shoe bars are some of the specialties that have regularly been shipped to important consuming districts remote from the valley, often in competition with mills to which these districts are naturally tributary.

Little is to be said of changes in Youngstown rolling mills the past year. In the preceding year, during the long shut-down, considerable improvement work was done. At the Union Iron & Steel Company's plant, a 10 inch continuous mill, begun in 1894, was completed last fall by the Morgan Construction Co. The building is 80 x 270 feet. Hoop iron is the product. Four mills are operated by the company,—one at Warren, with a capacity of 32,000 tons a year; the Girard mill, with 23,000 tons product; the Upper and Lower mills at Youngstown, turning out together 85,000 tons a year. The product of this company is of wide range, including iron for chains, nuts, bolts and agricultural implements; skelp iron and shafting; bar, hoop, band, hame, box and tire iron and steel, angles, special shapes and cotton ties, horse-shoe and guide iron.

The Brown-Bonnell Iron Co.'s mills are spread over 40 acres close to the business portion of Youngstown. They have the largest puddling plant in the valley, consisting of 48 double and 8 single furnaces. The 90,000 gross tons of product per year consist of bars, beams, channels, angles, universal plates, railroad and boat spikes, links and pins, washers, sheets and plates. The two main buildings of the plant, put up in 1892, are 60 x 220 feet each, with a connecting building 60 x 50 feet. The product of all the mills is brought on narrow gauge tracks to a single shipping point, and within a few hundred feet are the tracks of four trunk lines—the Erie, Pennsylvania, B. & O., and Lake Shore. About 1,600 men are employed, and when all departments are busy, 400 tons a day can be put out.

At the mills of the Mahoning Valley Iron Co., Youngstown, which are now starting up after an idleness of several weeks, the output consists of merchant bar iron, angles, tank, plate and sheet iron, steel cut nails, railroad spikes, bridge rivets and polished shafting. With its Hubbard plant, (12 double furnaces), the company has the equivalent of 58 single puddling furnaces. Its new building, completed in 1894, contains a 9-inch and a 12-inch mill. In the past year, more power has been provided in the shafting department, the output from which is 18 tons daily. Six waste heat boilers, four Cahall and two of the Cook type, have been installed in the puddle mill in the year. The annual capacity of the Mahoning Valley works is 45,000 tons.

The Haselton Iron Works of Andrews Bros. Co., at Haselton, a suburb of Youngstown, have been mentioned above in connection with this company's furnace plant. These mills have 11 double and 22 single puddle furnaces, 8 heating furnaces and 5 trains of rolls—8-inch, 10-inch, 16-inch and two 22-inch. The annual capacity is 36,000 tons of "Haselton" finished material, consisting of bar, plate, sheet, rod, skelp and band iron and steel.

Aside from the sheet mill at Struthers, formerly operated by Summers Brothers & Co., and bought by a new company last year, the Mahoning Valley mills outside of Youngstown and uncontrolled by Youngstown mills, are those at Niles. The Coleman-Shields Co.'s mill started 55 years ago, has 22 single puddling furnaces, 3 heating furnaces, a 20-inch muck mill and 24-inch plate mill. The annual output is 9,000 tons of pipe casing and tube iron. The Falcon Iron and Nail Co. turns out from its Russia Sheet Iron Mills 27,000 tons of skelp iron and 13,500 tons of black and galvanized sheet iron and steel. The Falcon Tin Plate & Steel Co. has an output of 5,000 gross tons of sheets and 4,000 gross tons of black plates. The tin plate plant of this company was completed last year, and up to Nov. 15 all departments of its works were in full operation.

FITTING UP A FOUNDRY.

BY CHARLES A. HAGUE.

A short time ago the writer had the task of arranging and fitting up a large foundry with cupolas, pressure blowers, elevator, a special and rather novel molding floor, and a belted power outfit.

The foundry is situated in the manufacturing center of a large city, upon property too valuable to be used for yard room, so the building itself was arranged for the accommodation of all the usual details of operation, and as most of the work was of the snap flask order, and also of duplicate work in sets of

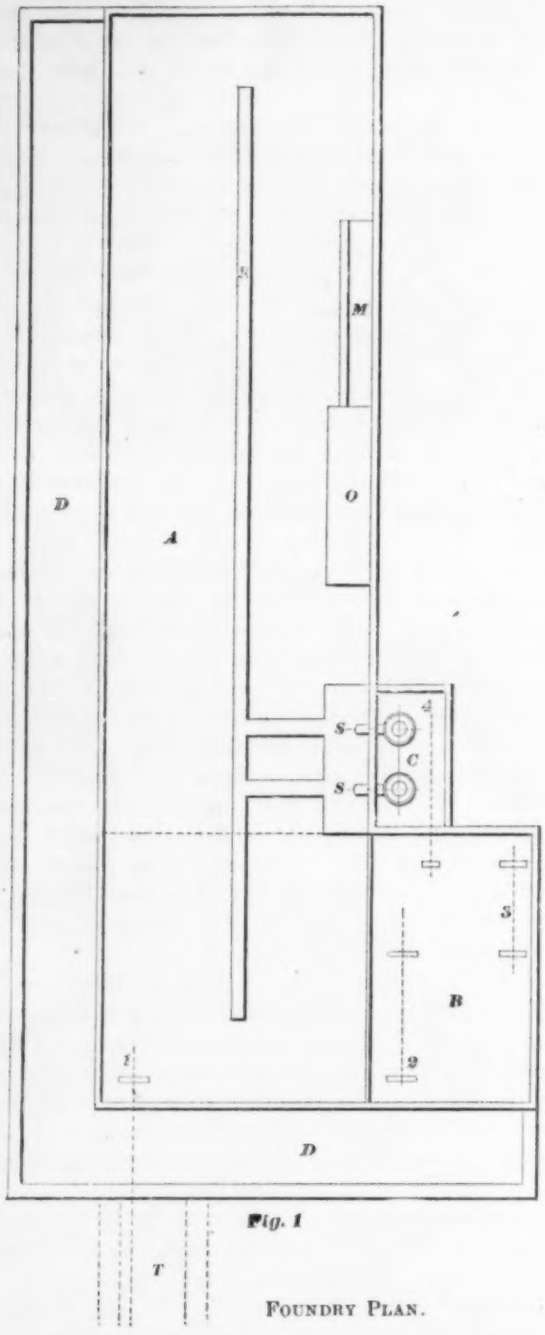


Fig. 1

FOUNDRY PLAN.

flasks, the matter of flask storage was not so formidable as it at first might seem. A few castings weighed as high as from 1,500 to 4,500 pounds, but did not amount to very many in number.

The building is in the form of the letter "L," the long leg of which contains the greater part of the main foundry floor; the short leg accommodates part of the foundry floor, also the cleaning room, tumbling mills, grinding machinery, etc., upon its main floor. The short leg of the "L" is three stories high, and the long portion of the building is a high one story structure with truss roof, thus leaving the greater part of the main foundry floor clear and free from obstruction. The second story of the short building contains a machine shop, and the third story is arranged for pattern storage, with racks and stalls which are lettered and numbered so as to bring this necessary but trying detail of foundry management down to the lowest possible terms of annoyance. A basement with a good solid cement floor, the clear height between the floor and the under edges of the first floor girders being 10 feet, extends under the entire building, so that one of the unusual features of this foundry is that the whole of the molding floor is supported upon columns, girders and floor beams, precisely as in the case of a warehouse. The cement floor of the basement was of unusually solid composition; there first being distributed over a bottom of good hard clay, stone spalls varying in size from four to ten inches, and to a depth of six inches; then over this was poured and spread cement mortar thin enough to thoroughly fill the interstices, the top being finished off in the regular manner with cement floors. The sidewalks upon the two street sides of the building are 16 feet wide, and as the building stands upon a corner a considerable space under the sidewalks is available for storage of the various kinds of sand, pig iron and fuel, removable covers in the sidewalks giving easy access for dumping such raw materials. The space under the sidewalks forms a continuation of the basement, so that supplies can be readily transported to the elevator. The main floor of the building is about four feet above the sidewalk, thus permitting of the use of large ports or windows, between the sidewalks and the main floor, for the further reception of materials, which through these ports went directly into the basement; the sidewalks of heavy planking were made strong enough to safely bear the heaviest teams and loaded wagons.

The short leg of the "L" extended about 100 feet upon one street, and the long leg 250 feet along the other street, both parts of the building being 60 feet wide. The foundry floor proper extended to the front of the short part, leaving the cleaning and mill room, 40x60 feet, at the end of the short building, the main foundry floor being 250 feet long and 60 feet wide. The cupolas, two in number, were placed in a special small building, situated in the inner corner of the "L," the cupolas facing the side of the main room and with their spouts extending through the wall. This small building was absolutely fire-proof, being constructed entirely of brick and iron, and containing cupolas, charging floor, and pressure blowers; the latter being located in the basement. The charging floor was accessible from the elevator which served building, this elevator having a platform 12 feet long and seven feet broad.

The main floor of the foundry is peculiar in its construction, being supported upon heavy spruce floor beams 3x16, these in turn resting upon 12x12 girders, the entire mass supported by heavy cast-iron columns. The wooden flooring is two-inch spruce plank, laid diagonally, and upon this was laid a floor of hard brick, similar to a common brick sidewalk, covering the entire main floor of the foundry proper. Runways, composed of cast iron plates ⅝-inch thick and four feet wide, extended the entire length of the molding floor, through its center, and also branched off to the spout of each cupola.

The melted iron was distributed to the extreme ends of the floor by means of two large tipping ladles, each holding about 1,500 pounds of metal, these ladles, mounted upon two large wheels and a steering wheel, being arranged to tip to either side, and double spouted for filling the hand ladles. The small work near the cupolas was poured by hand, the men catching the iron directly from the cupolas as it ran into the large ladles. There were generally a dozen double-handed ladles in service, so that when once the heat began generally the cupola was never plugged, but ran completely out, any small balance being run into pigs before the bottom was dropped. It was at first thought that there might be a tremor of the main floor to an extent which might endanger the firmness of the copes. A few experiments, however, satisfied the owners that the risks were really very small. When the main floor was paved, it was found that a perceptible tremor was one of its characteristics, sure enough, and before the time for the first heat rolled around some little anxiety was felt, but the very first trial swept away all the ideas that the sand would not hold together, and a better working foundry cannot be found.

As already stated, there was a machine shop upon the second floor of the short building, driven by one long line shaft

through the center of the room of 100x60 feet, the shaft running lengthwise of the room. Four tumbling mills, unusually large, situated upon the main floor, were driven from a line shaft extending along the end wall of the building, these mills being provided with exhaust fan conveniences, the fan driven from the same shaft as the mills. Four heavy double-wheel grinding machines were also situated in this room; these machines of special design (by the author) were driven from a shaft beneath the main floor in the basement. The elevator and the blowers for the cupolas were also driven from shafting in the basement.

The source of power was a line shaft in the middle of a large building upon the opposite side of the street from the foundry, and the problem was whether to cross with a wire rope overhead or by means of a shaft through a tunnel under the street. All things considered, conspicuous among the considerations being the power of the city authorities, which was rather against the wire rope on account of the fears of obstructing the operations of the fire department at some time or other, and the convenience of a private means of communication between the buildings afforded by the tunnel, the decision was in favor of the tunnel.

The line shaft from which the power was taken was 3⅞ inches in diameter, and made 265 revolutions per minute. It was desired to transmit, possibly, a maximum horse-power of 75, with easy belt conditions, so a pulley 42 inches in diameter to carry a 24-inch belt was put onto the line shaft. It was considered that the most important item in the entire outfit was the speed of the pressure blowers, and therefore the speeds of the various lines to be driven were calculated with this object particularly in view, it further being decided that allowances which would even drive the blowers a little above the desired speed were to be preferred to any possibility of the contrary. Therefore allowances for slippage and loss were made at every transmission of the power from one pulley to another. An allowance of 2 per cent of loss in speed for each pulley delivered to was made, so the drive from the 42-inch pulley on the initial line was to a 41-inch pulley upon a jack shaft at the side of the room; this jack shaft in turn, with a 42-inch pulley, drove down through an opening in the floor to a 41-inch pulley upon a jack shaft in the basement, and through a pair of miter gears the power was transmitted to the tunnel shaft which extended through the tunnel across the street. It will be interesting to know that the allowance for loss of speed of 2 per cent was just about right under the conditions for each drive, although the loss was probably a little less for the horizontal belt, and a little more for the vertical belt; at all events, the tunnel shaft, as far as could be ascertained from many trials with a speed indicator, made just about an average speed of 265 R. P. M., which was the speed of the line shaft in the room above.

The tunnel shaft was 3⅞ inches in diameter and 80 feet long, supported upon post hangers at one side of the tunnel. It extended ten feet within the basement of the foundry building at the outer corner of the "L." A pulley 60 inches in diameter was put upon the foundry end of the shaft, and revolved between two solid pine posts 10 inches square, extending from the basement floor, into which they were set, up to a heavy cleat secured to the under sides or edges of the main floor beams, each post supporting a hanger for the shaft bearings. This pulley, at 265 revolutions per minute, gave a belt speed of 4,160 feet per minute, with a belt 16 inches wide.

The first line shaft in the basement, and which received its power from the tunnel shaft, was 65 feet away from the tunnel shaft and was driven by a 48-inch pulley. This line, 3⅞ inches in diameter, was supported by extra heavy hangers, and at the driving pulley a hanger was placed at each side of the pulley, each hanger being stayed by a ⅞ inch guy rod, made adjustable, and led off to take the strain of the belt and prevent the shaft being drawn out of line by the driving strain. The shaft was placed as near to the floor beams as the diameter of the pulley would safely permit. The general arrangement and conditions brought the rim of the 60-inch pulley on the tunnel shaft within six inches of the basement floor, and the belt driving from this pulley onto the 48-inch pulley above referred to would completely shut off the passageway from the tunnel to the foundry basement, and to meet this difficulty the belt was raised and carried upon idlers, with the return to the driven pulley at the top running over one idler, and with the driving or pulling part of the belt underneath running over two idlers. This gave six feet in the clear between the lower portion of the belt and the basement floor. See Fig. 2.

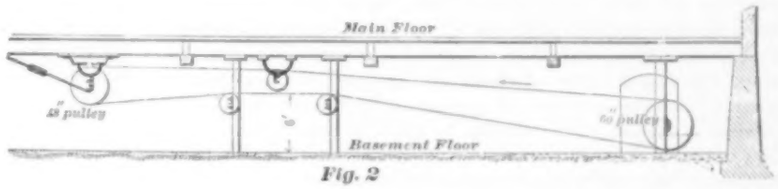


Fig. 2

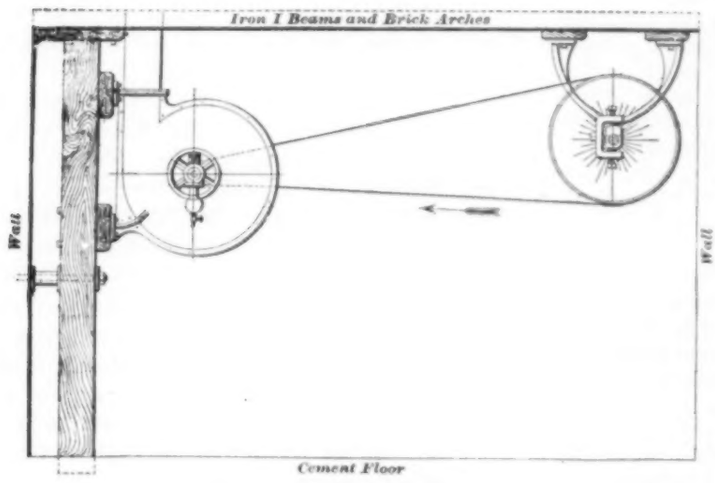


Fig. 3

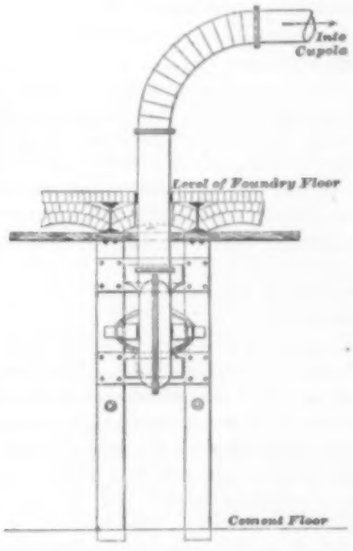


Fig. 4

A speed of 325 R. P. M. being desired for the first line mentioned, the ratio between 60 and 48 would give 331 R. P. M., and this, discounted two per cent, would just about make 325, so a 48-inch pulley was used. As the blowers for the cupolas were the objective point, as far as any particular matter of speed was concerned, they were taken up next, and the problem worked backwards, so to speak. These blowers, two in number, are No. 7 Sturtevant steel pressure blowers, mounted upon 8 inch square pine posts, two posts to each blower, in the basement room directly beneath the cupolas. The cupolas being supported upon the main floor level, so leaving the basement of the small fire-proof building clear and free from incumbrance, the arrangement of the blowers, a separate one for each cupola, was so that their delivery openings were directly upward, thus avoiding all bends in the blast pipes ex-

cepting the one necessary for the turn into the cupola. See Figs. 3 and 4.

The blowers were driven straight from a 2 3-16 line shaft making 425 revolutions per minute, they having been calculated to run at 2,300 revolutions, but the ratio actually figured up to 2,555 and then discounted 10 per cent on account of the great difference between the pulleys on the line and those on the blowers, so that the chances are that the blowers never fell below what was decided upon as normal speed. The blower line shaft was driven by a pulley 22 inches in diameter, carrying a 10-inch belt, receiving its power from a second line shaft in the main basement, the blower line extending out into the main basement for the purpose, this second line making 319 R. P. M. and carrying a 30-inch pulley driving to the 22-inch upon the blower line, a discount of two per cent being made between these two lines to allow for loss of speed, the result being a trifle above normal.

The blower line is 40 feet long, and probably a more beautifully running shaft could not be found. The pulleys driving the blowers are 36 inches in diameter and of six inches face, carrying 5½-inch belts of raw hide; these 36-inch pulleys were machine molded, and one of them is so perfectly made that no balancing weight is required upon its rim, so that when running at 425 revolutions per minute the arms completely disappear and the rim appears to be mysteriously suspended in the air, as no variation or mark to catch the eye can be observed. The other pulley upon the same line and within 15 feet of the perfect one required a half pound of iron to preserve its balance, going to show that the making of two machines "exactly alike" from the same patterns and yet operating differently can be very easily accomplished. The hangers supporting this blower line shaft are secured to the iron beams which form a part of the floor above, making everything so thoroughly solid that not the slightest sound can be discerned when the shaft is running at full speed before the blowers are started.

The 30-inch pulley on the second line shaft, for driving the blower line, is a friction clutch pulley, left normally in clutch, and when it is desired to start the blowers in the afternoon the clutch is thrown out, the blower belts put on and the clutch again thrown in; this particular method was not exactly contemplated at first, the idea being to throw out the clutch and leave it out, but the blower line turned so easily that it gradually acquired considerable speed, blowers and all, so that it was thought best to throw off the blower belts and allow the shaft to run, this incidentally keeping the belts out of strain when not in use, and saving the wear upon the hub of the friction pulley.

The machine shop is driven from the first line in the basement by a quarter turn belt passing up through the first story. The speed desired in the machine shop was 125 R. P. M., and as it was evident in the nature of things that considerable difference must exist between the pulleys, and as it was further considered that the belt must be a quarter turn, it was decided to add five per cent to the speed of the machine shop line before establishing the ratio. This made 131 against 325, resulting in a 48-inch pulley on the upper line, and a 19-inch pulley below. The grinding machines upon the main floor in the cleaning room already referred to are driven directly from the first line shaft in the basement by five-inch belts, the machines being located directly above the line shaft, and the machines started and stopped by tightening or slackening individual belts for each one, one important feature of this arrangement being that when the machine is at rest the belt is both at rest and completely loose; also the drive being from below the floor, all above is free from obstruction and danger to the operator.

A third line shaft at the end of the cleaning room, driven from the second line in the basement, transmitted power to the large tumbling mills. These mills also are provided with hoods and exhaust fan connections, so that when the cleaning room is working at full blast the atmosphere is most comfortably clear of dust and smoke, beneficial alike to the men and the machinery, resulting in more and better work at less expense in power and repairs than could possibly be accomplished under conditions of dust and dirt usually found in the old-fashioned way of cleaning castings.—[American Machinist.

CLEVELAND ROLLING MILL CO. ADDITIONS.

Early in the new year the Cleveland Rolling Mill Co. will put in operation a new blooming mill on which, with its auxiliary boiler, pit furnace, gas-producing and other equipment, work has been in progress for several months. The new mill will roll beam blanks, etc., for the structural mill which adjoins it, and billets and sheet bars for the company's rod and merchant mills. Billets rolled for the market will thus come exclusively from the old blooming and billet mill located at the other end of the plant, the converters which supply the two mills occupying middle ground. The new pit furnace building is 35′ x 100′, and the adjoining stripper house 25′ x 30′. In the latter is an Aiken stripper of recent design. The new blooming mill building has been erected as an extension of the structural mill and its location with reference to the latter, as well as to the merchant and rod mills, permits of the most advantageous and time-saving transfer of material as it is carried through the various manipulations from the soaking pits to the finishing rolls.

The pit furnace house contains three pit furnaces, each having a capacity of eight 14″ x 16″ 3,500-lb. ingots. The furnaces are commanded by a 10-ton electric crane, and the lift is accomplished by means of a screw which runs in oil. The crane has four motors, one for lifting, one for traveling through the building, one for the trolley and one for the tongs, which the operator is enabled to revolve in any direction. The ingots, when taken out of the pit, are delivered by a cable-driven car, with a tilting seat, to the 33-inch blooming mill. They are put upon the tables by the tilting mechanism, the valve being controlled by the roller. The blooming mill is driven by a 36″ x 40″ Robinson-Rea engine. The tables are operated by two Crane engines, 10″ x 12″. A 25-ton hydraulic crane commands the rolls and the engine.

From the blooming mill to the heavy 30-inch hydraulic shear the distance is 70′ 6″. The shear is operated by a steam intensifier, securing 1,700 lbs pressure to the square inch. The steel may be bloomed down to a 4″ x 4″ section, and sheared into 36″ lengths, weighing 150 pounds each, for the rod mill, or with fewer passes blooms may be made and sheared to appropriate lengths for the structural and merchant mills. An elevating and conveying equipment takes the billets from the shear to the rod mill, 180 feet distant, in a straight line, but for delivery to the rolls a turn is made at right angles and 200 feet additional traversed. From the shear to the heating furnaces of the structural mill the transfer of the blooms is speedily accomplished by means of a crane.

The boiler capacity of the plant has been much enlarged. The battery of eight boilers which supplied power for the structural mill was torn away to give room for the new blooming mill, and the two mills are now supplied with steam by 16 horizontal tubular boilers, 72″ x 18′. The gas producer house which serves the pit furnaces contains eight Wellman gas producers.

The entire plant of the company has been closed down the past 10 days for thorough repairs. Work will be resumed the coming week. It is expected that one Central furnace will be blown out early in the year for relining and repairs. Excellent work has been done at these furnaces the past year, both in output and in the control of silicon, and hot metal has been taken direct to the steel plant in ladle cars, a distance of two miles, over the Erie road. After the new blooming mill is in operation, the Cleveland Rolling Mill Co. will roll 15-inch beams, 12 inches being the maximum heretofore.

FURNACE PRACTICE WITH MESABI ORES.

BY F. B. RICHARDS.

Furnacemen drawing their ore supply from the Lake Superior district have had another year's experience with the product of the Mesabi range. A much larger proportion of these ores is being used in many instances than was anticipated; in some cases from necessity rather than on account of the difference in price between Mesabi ores and those from the older ranges. The heavy demands for Bessemer pig in 1895 and the curtailment of production on the older ranges have created this necessity.

There is still a prejudice in favor of the coarser ores from the older ranges, but it is not as strong as it was a year ago. This prejudice is in most cases from a dollars and cents standpoint, and bears directly on the price; in others it is fear of the difficulties in working in the furnace. Generally, however, the Mesabis are no longer the bugbear to the furnaceman that they were last season. He is willing to work a generous proportion in his mixture, but it must be at a difference in price that will pay him for his trouble in handling and working over his flue dust and for the perceptible loss from the top of his furnace.

While no specially designed furnace has been built to use these ores, every furnaceman has formed ideas of his own as to how to change his present plant to facilitate their use in larger proportion. And as furnaces here and there have gone out of blast for repairs, during the past year, changes have been made with this in view. In most cases, the tendency has been to increase the size of the hearth and to lower the bosh, so as to bring the point of scaffolding within or close to the melting zone, thus reducing to a minimum the chances of scaffolds forming. The construction of a system of explosion doors on the down-comers and around the top of the furnace above the stock line, to give vent to the severe explosions often following a slip, has been carried out in different forms. There has been, also, a tendency to construct larger down-comer area, either by putting up a second down-comer or two branches from the top uniting to form one large down-comer above the dust-catcher. In the case of a plant now being constructed, several down-comers at equal intervals around the top are being built. These enter a bustle pipe not very far down from the top and inclined at a very sharp angle from the horizontal, the bustle pipe then being connected to an immense dust-catcher by a very large down-take flue. The object in all cases of increasing the down-comer capacity is to give as great an area as possible for the passage of the large volume of gas being generated by the present practice of fast driving, thus reducing the velocity of the flow of gases and reducing to as low a point as possible the amount of fine ore held by them in suspension.

With the increase in blowing power and dimensions of hearth which has been developing the last few years, there has been no increase in tuyere area. At the above mentioned plant, now being constructed, where the dimension of the hearth has been increased very largely, it is said ten tuyeres will be used. There will thus be no dead space between tuyeres, the furnace should melt more evenly and the stock travel with less slipping and rolling, which causes more flue-dust than any other condition.

After all, the problem is still one of dollars and cents, for with a properly constructed top with plenty of vent for explosions and slips, the dangers and expense from these causes can be largely avoided. But the question of avoiding flue-dust or utilizing it satisfactorily, after it has been made, has not yet been solved; at least, not to the satisfaction of the majority of furnace managers. There is one here and there who says he has no trouble with dust, and uses up daily what the furnace makes. But the fine ore goes farther than the dust-catcher. It fills the stoves and underground flues, and deposits under the boilers. Perhaps it would not be untrue to say that a furnaceman's opinion as to the trouble he has with flue dust from Mesabi ores varies from time to time according to the amount of dust his furnace is making. He would probably be in line with the majority after cleaning flues and from under his boilers.

There is one furnace in the Pittsburg district at which the mixture used is almost entirely made up from Mesabi ores, and it is claimed there is very little flue-dust made. This furnace is working on a very fusible slag, low fuel, and making a fair quantity of iron. The furnace, however, is being run on a comparatively small quantity of blast when its cubic capacity is taken into consideration. It would be of interest to know the quantity of flue-dust made should this furnace be supplied with as large a quantity of blast as other furnaces of the same cubic capacity.

With the exception of this case, and perhaps one or two others, the opinion of the majority of furnace managers would be that this problem is not settled to their satisfaction. Here and there furnace companies are persistently at work on the proposition, and their efforts are bound sooner or later to be rewarded. One company is at present working on a scheme to sinter or melt together the dust by roasting in piles about 30 feet long, 15 feet wide, and 10 feet high, these piles being underlaid with wood and then built up of alternate layers of flue-dust and soft coal. Several experiments have been made with the view of making briquettes, using lime as a binder, but with no success. However, experiments are being made on this line now. Those having the matter in hand are trying to put the dust into eggettes, using pitch as a binder. If a commercial article is turned out in this form, it will depend entirely on the cost as to the extent of its use.

We hear only in a general way the experience of the furnacemen of Eastern Pennsylvania with Mesabi ores. Quite a block of these ores was shipped to that section last year and considerably more this year. Especially from the furnaces using all or a part anthracite fuel no complaints about flue-dust are heard. As one of the most successful furnace managers of that section puts it: "We have used the fine foreign ores for years and can see very little, if any, difference between some of these and Mesabi ores." If they were running their large furnaces on coke, with a liberal proportion of Mesabi ore in the mixture and blowing 30,000 to 35,000 cubic feet of blast per minute, making a product of 2,000 to 2,100 tons of iron per week, instead of half that quantity, they probably would be complaining of flue-dust and at work on the problem how best to utilize it.

While the furnaceman has been wrestling with the perplexities presented by these ores, the Mesabi range has developed to a point where it can ship, if necessary, more ore than its railroads can handle, with present facilities, and can always supply for some time to come any shortage of Bessemer ore caused by the exhaustion of the mines on the older ranges. So long as a difference in price exists between Mesabi and other ores of like chemical composition, the furnaceman will try to use the former in larger proportions; and by the time necessity compels him to make up the bulk of his mixture of Mesabi ore, he will have solved the problem and forgotten that there ever were any difficulties.

LAKE SUPERIOR IRON RANGES.

BY JOHN BIRKINBINE.

When the great ice fields moved over what is now the state of Minnesota, they planed down ridges and deposited in interlacing valleys glacial drift, leaving the watershed dividing the streams which ultimately find their way by diverse channels into the Atlantic Ocean less than 2,000 feet above tide. A canoe launched on either of three small streams within a few miles of the iron ore mines at Hibbing, Minnesota, could, barring cascades and high falls, be paddled down through the Mississippi River to the semi-torrid Gulf of Mexico, or be floated through the Rainy and Winnipeg Lakes into the sub-frigid Hudson's Bay, or it could follow the St. Louis River to and through the great system of lakes and out into the ocean through the St. Lawrence River and Bay, a journey of nearly 2,500 miles.

Close to this divide are the iron ore deposits which, by their quantity and quality, have in a decade advanced Minnesota from a non-producer to second rank as a contributor to the country's supply, furnishing a larger amount of iron ore per annum than any other state except Michigan, and more than any foreign country except Great Britain, Germany and Spain.

To reach these ore bodies, over 400 miles of standard gauge railroad have been built and equipped with modern locomotives and cars, through what ten years ago was a trackless wilderness, and in fact much of the active producing country was visited only as hunting ground to within three or four years.

Mesabi and Vermilion Repeat History.

But the story of the development of the Vermilion and Mesabi ranges in Minnesota is practically a repetition with local modifications of what took plaee in bringing in turn the Marquette, the Menominee and the Gogebic ranges of Michigan and Wisconsin into prominence as mining districts. The exploitation of the Marquette iron ore mines shares with the initial work in the copper mines the credit of opening up Northern Michigan within half a century, and the iron ores of the Menominee range were responsible for the settlement of the interior section less than two decades ago. Similarly the timber clearings, railroad building, etc., on the Gogebic range, to secure the soft ores, which lay unused until slightly over ten years past, were contemporaneous with the bold venture which brought into market the excellent ores from the Vermilion range in Minnesota.

We wonder at the opening up of the Mesabi range, because it is new, and because we consider it unique; but it is questionable, all things considered, whether it bears a more important relation to the iron trade of to day than the Marquette, Menominee, Gogebic or Vermilion range, each in its earlier history bore to contemporaneous business. The quantities of ore "in sight," the apparent ease of mining and the high grade of material won on the Mesabi range, may be pronounced marvelous, but the other ranges each in turn were surprises, and have done their part in making the Lake Superior region the greatest iron producing district of the world; for no other section has in forty years supplied 100,000,000 tons of iron ore.

The iron ore product of the Lake Superior mines in 1892 was double the maximum annual output of the noted Bilbao district of Spain, and one-half greater than the largest amount credited to the Cleveland district in England in any one year, and the average quality of the ores obtained from the Lake Superior mines is not equaled by any other large producing district.

Had the Mesabi range been opened simultaneously with the Vermilion and Gogebic ranges, it would have been less successful than it is now, for at that time more costly mining, higher transportation and handling charges, etc., would have handicapped the mines, and the furnaces then active could scarcely have received the extra supply. The late business depression was a blessing in disguise to the Mesabi range in so far as it curtailed a wild speculation in mining ventures which threatened to greatly injure the district, and restricted the exploitation of mining properties by parties with insufficient capital to carry the work to completion. As it is, progress has been phenomenal, and the youngest of the five iron ore ranges has in its fourth year of development supplied between one-fourth and one-third of the total iron ore from the Lake Superior region.

The Mesabi's Proportion in 1896.

It is probable that the strike in the Marquette range was in part responsible for the record of 1895, but making the fullest allowance for this, the Mesabi range would certainly have supplied over one-quarter of the total product of the Lake Superior mines in 1895. What will be its proportion in 1896, is a question now interesting those engaged in mining on this new range, and one prominent in directing operations there has given the estimate of 40 per cent.

Viewed by one who has no financial interest in the mines of any of the Lake Superior ranges, but who endeavors to gauge each from the standpoint of a supply for the iron works of the country, the problem may be summarized as follows:

The advanced rates which prevailed in the latter part of the year 1895 were not alone helpful to the Mesabi mines, but either have or will encourage operations on the other ranges as well as at a number of iron ore mines in various parts of the country nearer the consuming blast furnaces than the Lake Superior region, and importations of iron ore were augmented materially. In addition, there is a more decided effort to produce steel by the basic Bessemer and basic open hearth methods than at any previous time. It is therefore probable that if the rates of iron ore are maintained at what the producers consider profitable figures, the proportion which the Lake Superior ores bear to the total consumption in 1896 will not exceed that of 1895. If this assumption is correct, any gain to the Mesabi range must come by reason of reduced outputs on the other ranges.

Advantages of Ranges Compared.

The Vermilion and Gogebic ranges produce ores mainly of Bessemer grade, the former generally hard, and quite high in iron, the latter as a rule being soft, and lower in iron, with the condition of some of its prominent mines indicating that the range has produced its maximum, and will be a less important factor than in the past. The ores of the Vermilion range reach the nearest lake ports by an average railroad haul of 75 miles, those of the Gogebic having to cover an average of about 45 miles.

The Marquette and Mesabi ranges have closely approximated each other in supplying 40 per cent. of Bessemer and 60 per cent. of non-Bessemer ores, although the latter may in the future outrank the former in the proportion of this grade. The Marquette mines reach the nearest lake port by from 15 to 30 miles of railroad, say an average of 20 miles, but the Mesabi ores have to cover an average distance of over 75 miles to reach the docks.

The Menominee range produces mainly non-Bessemer ores which are carried by railroad an average of 50 miles

before obtaining water shipment and has its outlet on Lake Michigan, avoiding delays due to canal passage, with shorter vessel carriage for much of its output. It is also closer than any other range to blast furnaces in Illinois and Wisconsin, which can receive the ore by all rail routes.

This advantage of shorter vessel haul is also shared by a considerable portion of the ores from the Marquette district, and some from the Gogebic range have also reached water transportation on Lake Michigan by a railroad haul of 150 miles. But with the completion of the enlarged lock at Sault Ste. Marie, the encouragement to send ores from the Marquette range via Lake Michigan will be less pronounced, except for such as are supplied to furnaces on, or adjacent to that lake.

Taking the above distances as representing average railroad haul, and omitting from consideration the comparatively moderate quantities sent forward by all rail shipments, the statement may be made that independent of the character of the ore mined, the relative advantages of the different ranges as bases of supply for existing iron works may be judged by the combined rail rate from mines to lake, and the water rate from shipping to receiving docks. These vary from year to year, an increase or decrease in one or another influencing temporarily the various ranges. But the total transportation charges at any one time will be dependent upon the distance by rail from mine to shipping dock, and the prevalence of favorable or unfavorable grades, plus the distance covered by water transportation to receiving dock, the latter being subject to discount or premium by the quantity of other freight offered at or near the lake shipping point, and the amount of west bound traffic which finds advantageous rail transfers there.

Water Hauls Compared.

It is probably fair to equate possible rail and water transportation costs as 6 to 1, i. e., the cost of rail freight under average grade conditions for 50 miles will convey by water an equal weight of ore 300 miles (this comparison includes necessary dock charges). We then would have the following as indicative in a general way, of the physical relations of the various ranges to a point on Lake Huron nearly opposite the straits of Mackinac. This is selected as a locality which must be passed by all ore going to the lower lakes and also one representing fully two thirds of the distance from Escanaba to Chicago. The lake distances are not offered as exact, but merely as approximations and an allowance of 20 miles is added for delays of freight passing through the St. Mary's river after improvements now in progress are completed. The average total haul, as equated above to water transportation, to a point near the Straits of Mackinac is, from the

Marquette Range	.....	415 miles.
Menominee "	.....	510 "
Gogebic "	.....	740 "
Vermilion "	.....	940 "
Mesabi "	.....	960 "

These figures are for ores en route to lower lake ports, and to each must be added the distance to be covered from the point chosen in the upper portion of Lake Huron to the port for which the ore is consigned.

The statement is only intended as intimating the physical relative locations of the different ranges as a source of supply to Eastern consumers, and is subject to modification on account of gradients. However, the total altitude to be overcome does not vary greatly in any of the ranges, but the shorter hauls may be credited with a greater proportionate allowance for terminals. The figures indicate that the total average haul from the mines on the Marquette range is less, and the Vermilion and Mesabi ranges greater, than the average haul from the two other ranges, and the relative transportation facilities may therefore be rated in the order above named, subject to modifications mentioned, and to the cargoes offering return freight, or for competitive east-bound transportation.

To overcome permanently the natural disadvantage of the longer total hauls, the Minnesota ores must then be of superior grade, or be produced at a cost (royalty included) below what other similar ores, nearer to consumers, can be marketed for. As previously stated, the proportion of Minnesota ores which are of Bessemer grade is as great, if not greater, than the proportion obtained from Eastern Michigan, and the problem of future competition for Bessemer or non-Bessemer ores will resolve itself practically into a determination of the expense of mining (royalties included) per unit of iron in the ore won.

Physical Condition of Mesabi Ores.

The objection to the physical condition of Mesabi ores may be considered merely as of temporary character, and the statement that blast furnace managers cannot use the fine ores is a reflection upon the ability of men who have accomplished greater results than that of adapting their plants and their practice to the use of a deposit of such magnitude and character as has been developed on the Mesabi range. Men who have mastered the problems of producing pig iron within the narrow limits of chemical constituents acceptable to consumers, and who have reduced fuel consumption to a point approaching theoretical possibility, will find means to use liberally ore of good quality which can be supplied in quantity, whatever its physical condition. The engineering skill which has designed blast furnaces which produce liberal amounts of metal and are maintained in blast for long campaigns, can also perfect modifications in the method of charging, in the shape of furnace, in the gas-removal appliances, or in other structural features which will reduce to a minimum any annoyances from comminuted ores. It is remarkable, considering the objections raised, that the Mesabi ores obtained such a strong foothold when their introduction was largely at a time when furnace proprietors were expending little or nothing in improvement, and managers were not encouraged in experiments, but it is questionable whether this introduction was not as a rule at prices which left no profit for producers.

The Mesabi ores are in the market as a permanent factor, but not necessarily as supplanters of other ores of acceptable quality which are economically mined. The low cost of winning ores from some of the underground mines in other ranges which have obtained considerable depth, evidences conscientious attention to details, and demonstrates the necessity of strict economy in competitive mines which obtain ore from large bodies close to the surface. The steam shovel and milling mines of the Mesabi range are very attractive, and appear to offer extraordinary advantages in mining, but experience has already shown that the cost of removing, and of securing ground for depositing, large quantities of stripping, in which boulders form no inconsiderable proportion, are not bagatelles. Continuous work in a rigorous climate gives under-ground mining an advantage over methods which are interfered with by inclement weather, and, taking into consideration the royalties paid, there is little reason to expect great differences in the cost of mining ores from the best mines in the various ranges of the Lake Superior district. The variations in phosphorus contents of some of the Mesabi ores, and the cost of repeated samplings

and analyses to properly sort the product is another factor at the present market rates of Bessemer and non-Bessemer ores, and the necessity of taking out both the latter forces the sale of that less desirable in competition with ores of practically similar character nearer to points of consumption. When ores from the Mesabi mines are sold at prices yielding satisfactory profits, ores in other districts can be similarly marketed, and although the active competition may affect individual mines, the five ranges now producing may be expected to continue operations.

Iron Industries at the Head of the Lakes.

It will not be surprising if in the future a considerable portion of the Minnesota ores find a market at or near to the head of the lakes, for, notwithstanding the apparently unsatisfactory outcome of ventures in iron and steel production at Duluth and West Superior, enough has been accomplished to demonstrate that when ample capital is at command to buy material best suited to requirements, and to introduce the product into a market already supplied by established industries, ventures of this class will become profitable.

With the wealth of iron ores convenient, and the low rates at which fuel can be brought to Lake Superior, the production of metal for the rapidly growing territory to the west seems to offer many opportunities. A failure to treat ore, not at present apparently valuable, so that it may in the future be obtained for use, evidences a want of faith in the future of the Northwest, and it is well to remember that the average yield of all the iron ores used in the United States does not exceed 54 per cent., while the phosphorus in non Bessemer Mesabi ores is not as great as in the average non-Bessemer ores of the country.

The subject has purposely been treated in a general way, for had present prices and existing freight rates been used as illustrative, they would have told only a contemporaneous story. The exploitation of the various ranges of the Lake Superior region will continue beyond the present year and their future relations to each other may have to be gauged by different bases. As depth of workings increase, additional items enter into the cost accounts, and a change in the chemical composition of ores may benefit or injure individual operations, while competition in transportation or its absence and the amount of freight offering will for the time being influence tariff charges.

Stopping Machine Shop Leaks.

An excellent suggestion is made by Mr. W. O. Webber, writing in the *American Machinist*, which should be brought to the attention of everyone who is connected with the management of shops. This consists of plotting the shop costs of regular processes and comparing them for different weeks or months. The pay roll is presented by a curve, the amount of machinery produced by another and from these is deduced a third, which presents the cost per piece. This method may be employed to dissect the total cost of work into its elementary operations, which may then be easily compared. The writer says, "it is surprising how much can be done by one smart young man, who has had some experience himself in shop work, in discovering and plugging up the leaks in a machine shop, by taking the time slips from each man and playing a sort of game of solitaire with them to determine the exact value of the different manipulations," and he also says that it is surprising how great an interest a foreman, if he has his employer's welfare at heart at all, will take in these figures and how he will help to find a remedy for defects. The writer speaks from the standpoint of a manufacturer to whom the relation between cost price and that for which goods are sold measures his material comfort and pleasure in life. With this incentive he had reduced the cost of castings as much as three dollars per ton and found the possibilities of saving istributed over the whole shop.—[Railway Review.

ELECTRICITY IN IRON-WORKING.

SPECIALLY CONTRIBUTED TO THE IRON TRADE REVIEW.

Within the past two or three years the use of electricity for power purposes in manufacturing establishments has been of phenomenally rapid growth—so rapid, indeed, that the electrical factories have been and are hard pushed to manufacture apparatus in sufficient quantities and sufficiently quickly to supply the demand thus suddenly thrust upon them from all sides. Manufacturers, in the beginning of electrical things, had not been slow to discover the many advantages which electricity would confer on the establishments into which it might be introduced, and gave a speedy and gratifying welcome to the electric light. They found it a better, more flexible, and, in the aggregate, a cheaper method of illumination than gas, and readily realized the superiority of the incandescent lamp over the little upright lambent flame which a chance gust might bring into contact with inflammable material, ruining in a few minutes the concentrated results of years of labor. They found that the electric current could be taken anywhere, almost, merely by adding a few lengths of wire, and that light could be thrown in places hitherto never illumined except by the fitful glare of the dangerous match or the tallow candle. They found that wires could be strung in any of the walls and ceilings, and that incandescent lamps could be suspended from any point and be placed directly over the machines, which could thus receive a perfect light and give the workman a chance to operate without detriment to himself or his work in obscure days or in obscure places. The arc lamp lent itself admirably to the general illumination of factory interiors and the adjoining roadways and alley-ways, giving a clear white light impossible with any other illuminant.

The electric motor was of a later growth. The electric light had already become very perfect before the attention of electricians had been turned to the motor. As the current first used for commercial lighting purposes was the direct or commutated current, so the first practical motors were direct current motors, and these still remain the standard to which all motors operated on alternating circuit systems are compared, although the later modifications of the latter bid fair to supplement the former, especially in transmission work.

The first motors placed on the market as commercial devices were necessarily crude affairs, but their success was immediate. However, it took no great amount of persuasion to convince men that the electric motor was a distinct advance upon anything in the motor line that had gone before. As is the case with all new things, it encountered the ingrained conservatism of a century of education on, and experience with, older methods. Manufacturers, while willing to admit all the advantages which the electric motor presented over the steam motor, were not so willing to experiment with it, nor to discard the steam engine, which, with whatever shortcomings, had rendered such excellent service. The manufacturers had, therefore, to be put through an educational stage by the electrical manufacturing companies. This period of education has now been passed.

Economies of Electric Motors.

The advantages which an electrically driven factory presents over one driven by belts from an engine are these: The use of electricity relegates the furnace, boiler, steam engine and electric generator to a building separate from the factory and induces a decrease in insurance rates corresponding to the additional safety secured. It reduces

the expense of belting very considerably. There is no waste of power in running a large amount of idle shafting, pulleys and belts. The machinery can be placed anywhere without regard to the question of alignment. The repair and maintenance account is reduced. The power is transmitted by simple wires. The current may be shut off from any part of the factory instantaneously. If short lines of shafting are driven by separate motors, each separate line can be shut off when required, and, similarly, is the case of the individual machines driven by individual motors. There is no waste of power; the instant the current is shut off from a motor, the demand on the dynamo, so far as that motor is concerned, ceases. It will be seen that the installation of electricity tends towards economy in operation, and the money saved by the adoption of electricity is almost certain to reach a total which will not only cover the interest on the first outlay, but leave a considerable margin for a sinking fund.

An admirable instance of the economy of power in iron works, where previously the machines were driven by separate engines, was given recently by Mr. Selby Bigge. He showed that in order to drive a series of machines such as cold saws, saw sharpeners, double end punch machines, straightening machines, etc., the total indicated engine power necessary amounted to 94 horse power; whereas, after electricity was substituted, the total power of the motors required to do the work of the discarded steam engines amounted in the aggregate to only 29 horse power. The saving in coal effected in the operation of the machine tools in question amounted to not less than 30 tons per week.

The National Arms Co., of Belgium, the machinery in which gives employment to two thousand hands, operates its plant by electricity taken from a 500 horse power generator. The total efficiency, reckoning from the indicated horse power of the engine, is given at 71.3 per cent. In calculating the economy induced by the change, it was found that for a certain part of the work, which, previous to the introduction of electricity, had taken three tons of coal per day, the expenditure was reduced to less than one ton for the same amount of work done.

Applications in Iron Manufacture.

In the adoption of electricity both for lighting and power purposes, the owners of iron-working establishments have not lagged behind. Indeed, it may be said that they were among the first to realize the advantages which electrically-driven machinery presented over machinery driven from the steam engine, and to-day hundreds of iron mills, engine works, tool and machine shops are benefiting from the advantages of the newer system. It must not be supposed that electrical engineers are the most ardent advocates of the use of electricity; it will probably be found that most of the missionary work still necessary is done by users of electricity, who feel themselves far superior to those who still use steam exclusively.

There seems to be no limit to the uses to which the electric motor can be put in the iron-working establishments mentioned above, and the list of different applications would occupy far more space than can here be allowed. In foundries and machine shops, traveling cranes are now rapidly being equipped with electric motors. They are operated from the small cage at the side, and the forward and backward movement of the crane and the lateral and vertical motion of the lifting chain can all be controlled by the slight movement of small levers. Ladles can be readily transferred from point to point in the foundry, and castings can be equally as readily placed where desired. In the machine shop the advantages of the electrically-driven crane are apparent enough and need no mention here. Those at the Watervliet Arsenal, capable of lifting 75 to 150 tons, are known the world around.

The electric motor has also invaded the rolling mills and in one a 30 k. w. motor is connected directly to the rolls. This machine has been built to reverse every ten seconds. At the Carnegie Steel Works, at Homestead, Pa., motors operate small buggies, which carry the hot billets from the heating furnace to the rolls. Two motors are placed on each buggy, one operating the buggy itself, the other driving rolls on the buggy, to place the billets on the transfer table carrying them to the large shaping rolls. This buggy is operated entirely from a distance, current being led to the motors by means of swinging cables.

In the works of the Wrought Iron Bridge Co., Canton, O., motors drive punches, shears, small drills, large drills, bending machines, etc. A 10 horse power motor drives a milling machine making a cut one square inch deep in a steel plate 16 inches wide, over the entire surface. In another part of the shop is an 8½ horse power motor driving a combined punch and shear, the shear cutting steel 10 inches wide by 1½ inches thick. A 3 horse power motor drives two drills, each capable of boring 3½ inch holes in wrought iron or steel. In still another part is a 5 horse power motor, driving two punches; one punches holes ¾ of an inch in diameter in one-inch steel and the other ¾ of an inch in half-inch steel. In these instances, the motor is connected to the machinery by means of belts.

In the works of Wm. Wharton, Jr., & Co., Philadelphia, some of the motors are driven by belts, while others are direct connected. One of 20 horse power drives two rattlers, and the blowers and the elevator in the foundry. One of 5 horse power drives circular saws and grind-stones in the pattern-shop; one drives an emery wheel and drill press in the foundry and two motors are directly coupled to machines which carry slowly-driven cold saws. Another operates a vertical punch press and a third drives the horizontal punch and bender.

At the Eberhard Mfg. Co., Cleveland, O., the blowers for the cupolas are entirely driven by electrical motors. At the Pencoyd Iron Works, Pencoyd, Pa., a 125 horse power motor replaces a steam engine and drives a hot saw revolving at 1,800 to 2,000 revolutions per minute. In the works of the Pennsylvania Steel Co. there are a number of motors applied to various purposes, such as driving blowers, hauling loads up inclined planes, driving centrifugal pumps, etc.

Direct Connection and Belt Methods.

The foregoing will give some idea of the diversity of uses to which the electric motor can be put. The question of having the motor directly mounted upon the machine itself or belted to drive short lines of shafting, is one which must be determined by the conditions of the case in point. It will readily be seen that there are cases where direct connection of the motors would present advantages over the belt method, while in other cases the operation of a number of machines from a countershaft would be more economical. In some works both methods are employed. This is the case in a large iron bridge and roof works at Greenpoint, L. I., where a number of machines are driven by individual motors, while two or three are driven by one motor through a short line of shafting. A visit to this plant shows in small compass the superiority of electrically operated machinery. The machines are placed to suit the work and not with refer-

ence to any question of alignment, and there are no belts. The work being intermittent, the generating plant has been designed accordingly, and there is a generator of 75 horse power with a motor capacity in the works of 140 horse power. The tools are placed over a very large area, and if they had been driven from shafting, the power necessary to drive the shafting alone would have been greater than that required by all the tools usually running at one time.

A brief reference may be made to electricity for welding and metallurgical operations. The electric furnace is a fact, and within the next two or three years we shall probably see this developed and brought within commercial reach.

In the foregoing, we have confined ourselves to pointing out the advantages of electrical operation only. The question of the source of power is one which is to be determined by locality. In some cases it must always remain the steam engine until new discoveries cause it to be discarded; in other cases it may be water power, which can be made to supply both heat and light and power at the same time. By the improved methods of power transmission which have been developed within recent years, the power of water falls many miles distant may be brought to the doors of the factory; and there is a steady and encouraging increase in the development of these forces which nature has lavishly provided.

Although electric power is used in many of the iron-working establishments throughout the country, it is not so extensively employed as it might be. But manufacturers are not blind to their own interests, and it will not be long, probably, before we find exclusively steam-driven works the exception, to be cited as a survival from the past.

HOW MUCH HAVE YOU MADE?

BY W. L. CHENEY.

The end of the year is approaching, and brings with it the season for inventory and the figuring of profits (or losses); and the question of how much has been made (or lost) is to occupy the mind of every shop proprietor until the inventory is over, and the question answered. With this in view, let me quote and use as a sort of text the remark recently made to me by the manager of a highly successful concern, as follows:

"It is not enough to know that you have made money *this* year; a question of *still more* importance is, 'Are you in condition to meet competition and make money *next* year?'"

It has been said there is nothing absolutely new; certainly there is very little absolutely new in mechanics, or in business principles. Twice one is always two. It follows that we must to a certain extent copy others. Therefore let us copy those who are successful. In this light the remark of this successful manager is worthy of attention.

As a "firstly, my brethren": If you are *not* in condition to meet competition and make money *next* year, you have not practically, and to all intents and purposes, made anything *this* year, no matter what the inventory says. In other words: the expense of keeping everything "up to date" is part of the legitimate running expenses of the business, and must be met, just as surely as the coal bill must be met.

If this is not so, what is going to pay for the improvements that you must make next year, in order to be "in it," if you have not already made them during this year?

If you don't make them next year, where will you be year after next?

Ask any one of the hundreds of concerns who are going down hill—who are changing managers and superintendents at every annual meeting, in a vain struggle against fate—and they will tell you that when they first started business, they took every cent that they made, put it in their pockets, and thought no more of the matter until they ceased to make enough to put in their pockets. Then they realized for the first time that they were "behind the procession."

As likely as not, this policy was followed by the original managers in order to make a "good showing" and to keep on good terms with the stockholders (if a stock company) or with themselves, taking chances on the future for the sake of an apparent present advantage: trying to build themselves up at the expense of the future good of the business. They didn't treat the stockholders or themselves fairly or honestly.

If you are the owner of a small or medium manufacturing business, and have not made enough this year to pay for the improvements necessary in order to keep in the swim, be honest with yourself and tell yourself so, or if you are manager for a company, be honest with the stockholders and tell them so.

I have an old fashioned theory that it pays in the long run to be honest, both with ourselves and others; and I hope to live long enough to see that my theory is correct.

I believe it will pay the manager of a company, in the long run, if he has lost money this year, to tell the stockholders so, even if he loses his position in consequence.

One of the worst manufacturing failures that ever came to my notice was caused by unfair inventorying. The manager carried along his stock and plant at a watered value, in order to "make a showing" and keep his position. Of course the smash came in due season, and the manager was "out of a job" then, anyhow.

Would you hire this manager? Certainly not.

Could you reasonably expect anyone else to hire you for a manager under similar circumstances?

If you had done the same thing in your own business, would you hire yourself over again?

I know of one concern that carried along all their 20- to 40-year-old machinery on their books at the price they paid for it when new, and claimed that they couldn't understand why they were not making any money now, when they used to make so much.

If they had taken part of the money that they thought they had made in the past, to pay for depreciation and improvements, there is no reason why they should not *really* have made money to this day, as the circumstances of the concern were particularly favorable for money-making. Yet I have seen the time when this concern didn't feel able to repair a leak in the roof!

In making up an inventory, something must be taken from the book value of everything about the place. The roof will leak by and by. Some of these days a new floor will be necessary. The windows really ought to be washed once in a while, and even this costs something.

If you haven't made enough to cover these and a hundred other things of the same nature, you haven't really made anything.

AT the recent New York meeting of the American Society of Mechanical Engineers, an original drawing, plan and elevation, of the steamboat "Robert Fulton," dated March, 1813, with notes and directions in the writing of Robert Fulton, was presented to the society. The drawing, which is in excellent condition, has been framed for many years, and had been in the possession of George L. Schuyler.

A MODEL CAR WHEEL PATTERN.

BY JOS. LEON GOBEILLE.

The methods employed in the making of patterns for castings have progressively improved along with everything else, but this fact is not generally acknowledged. There are two conspicuous reasons for this: first, the pattern itself seldom shows much difference, whether well or ill-made, and tells nothing whatever of processes, and if it does, no pattern-maker is likely to see it after once it is started in the foundry and, secondly, there is less "literature of improvement" in pattern-making than in other industrial arts. When a bright man does a clever thing in the pattern-making line somehow it seldom gets into print.

To prove advancement in any special line, we should contrast a simple example made to-day with the same thing of a former period; so we select one of the simplest standard patterns in general use—a car wheel; it is nearly all lathe work and, barring the chill, the easiest kind of a turning job, and we show here one of 36 duplicates, made under the supervision of the writer, for the greatest railroad in this country.

Fig. 1 shows a one-half 36" D wheel section; dimensions as shown by scale, also a quarter plan of reverse showing shape of ribs. The principal requirements of the specifications were that the pattern should be made of approved second-growth cherry, veneered on both sides with metal wherever the pattern would touch a face plate when inspected, and, on the tread, four grab-irons, and eight metal plates to take the wear of the chill. The core prints were to be metal, but the weight complete could not exceed *forty-six* pounds. As the cherry selected weighed nearly ½ oz. per cubic inch and the metal parts were all ⅛", the drawing-room weight was 78 pounds, after saving as much as possible in the interior construction.

Being unable to get the specification weight increased, the pattern was made as follows:

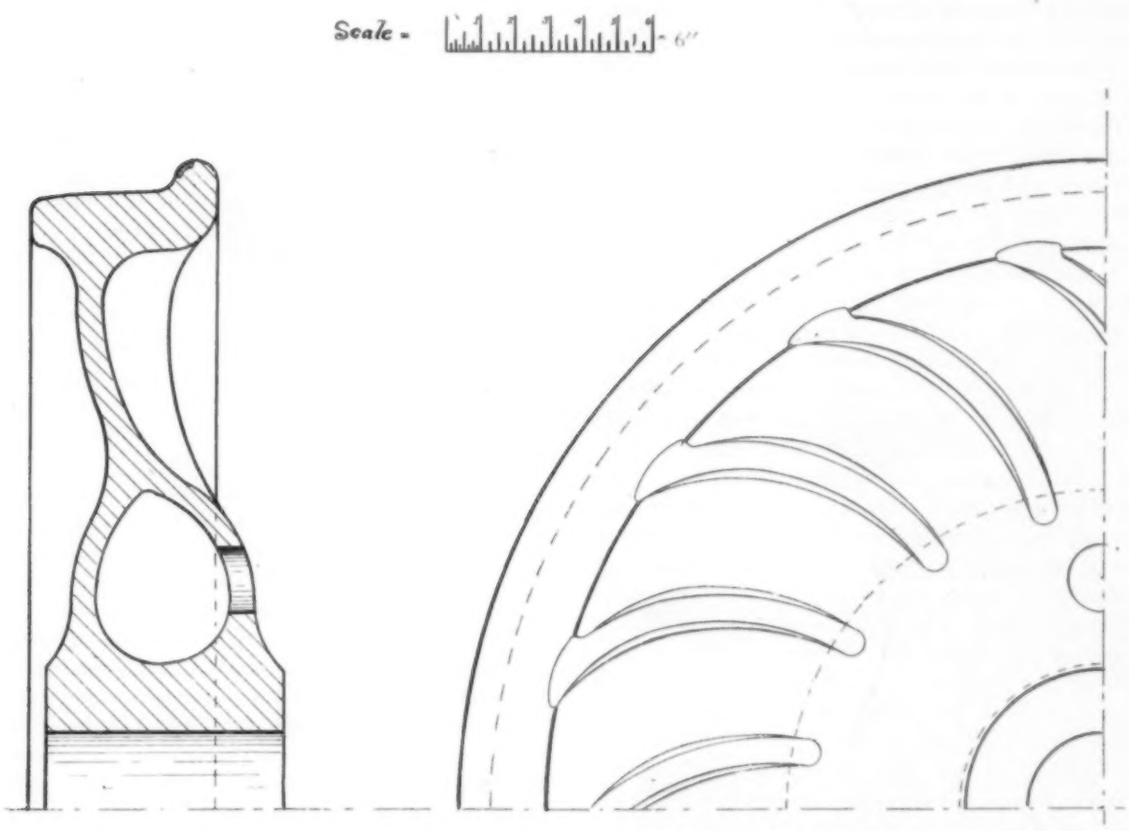
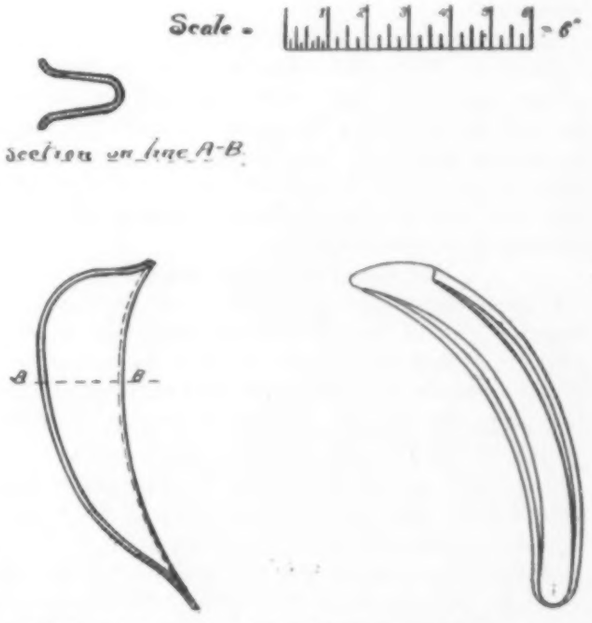


FIG. 1.

The two faces were turned separately inside and out, leaving ¾" solid cherry. The hub center was built segmentally of pine uppers, with twelve radial struts of the same material, which were glued in, to correspond with the outside ribs. The sixteen ribs were made of a hard alloy 95 per cent. aluminum, $\frac{1}{12}$" thick, as shown in Fig. 2. The prints were made hollow the same as the ribs, but of 92 per cent. aluminum, while the balance of the metal work, including the lettering, was made of the 95 per cent. alloy. The result was a pattern under the specified weight, which is practically everlasting. The pattern was finished natural color with a French oil finish, all done on a varnishing lathe, before finally screwing on the ribs (which had been previously fitted), and when shipped each wheel looked as fine as a gold jack-plane.



THE GROWING FIELD OF COMPRESSED AIR.

BY HOWARD A. PEDRICK.

Compressed air in the past has had its own peculiar uses. Few realize its present possibilities in the field of industrial art. Railroad shops were the pioneers in introducing it for a few shop purposes, mainly the testing of the air brake. Proving such an effective power, readily conveyed long distances without loss from condensation, easy to handle and clean, has opened for it uses which are extending every day. Air compression has engaged the talents of some of our ablest engineers in bringing out types of machines calculated to meet the requirements of the most modest to the largest consumers; although the average shop, with a compressor capacity of from 40 to 80 cubic feet of free air per minute, can accomplish a wonderful saving and convenience with such a quantity.

The locomotive air brake pump is not economical for shop duty, nor is any pump without a shaft or fly wheel, as the steam used is not utilized expansively. The line shafting has always sufficient margin of power to run a compressor of the capacity mentioned above with very little cost to the user. The steam engine is better adapted to use the steam expansively than the average air compressor. The two-stage or compound compressor is the nearest to being the ideal machine, inasmuch as the large or gathering cylinder is used with a large area to take in the free air and partly compress it before entering the high pressure cylinder, which is one-fourth the area of the large or gathering cylinder; from experiment it has been found to be exceedingly severe duty for the machine to compress the air to a pressure of 100 pounds per sq. in., using the large piston only, as the increased area against the full pressure consumes a large amount of power. But placing the high pressure piston, with an area of one-fourth the low pressure piston, and operating the two in conjunction with each other relieves the machine and takes very much less power. Water circulating around the outside and ends of the cylinder is quite necessary in a good type of compressor, as the heat generated by compression of the air, unless cooled, is a waste of power, besides burning the lubrication from parts of the compressor needing lubrication.

The air receiver or storage tank should be of liberal dimensions. Very often a mistake is made by having the storage capacity too small. The main line of piping leading from the receiver to the points of distribution should not be less than 1½″; larger piping than this is better when the air is used at a greater distance than 300 feet from the receiver and being consumed at about the capacity of the compressor.

The Use of Pneumatic Hoists.

Properly constructed pneumatic hoists are playing an important part in the utility of compressed air for shop purposes, as they produce a lift which is far more speedy than is usual with the chain hoist, and require no manual exertion to raise the load. Pneumatic hoists are now constructed so that the most unskilled person can raise the load to any desired height, within the scope of the hoist, and adjust it to the finest point possible. With the operating valve open, the load will remain constant in any desired position, just as long as the air pressure is maintained in the receiver. These hoists have been so perfected that they are now used for handling ladles of molten iron in foundries. Formerly, when air hoists were used for such work, as the iron was poured from the ladle the load gradually became lighter, allowing the air to expand in the hoist cylinder, causing the ladle to rise; this defect in operation is now overcome by the employment of a relief valve so arranged that a slight movement upwards of the hoist piston causes the automatic relief valve to open and release an amount of air just sufficient to maintain in the same position the gradually reducing load.

Pneumatic hoists are so very much quicker in serving the different machines that their economical services are very soon felt both in the saving of labor and increased output. The use of the pneumatic hoist on a long runway or overhead rail has been open to the objection that the conducting hose is in the way. The best practice now is to have along such a run-way several hanging hose arranged that one can be connected to the hoist where the previous one has reached its limit. This plan would not be practical were it not for the automatic coupling, which can be manipulated very quickly. The severing of this coupling completely shuts the air pressure off by the automatic operation of a small valve, and when the coupling is connected again, this little valve is pushed from its seat, admitting air through the hose without any impediment. It is preferable to employ such automatic couplings for hoists intended to serve long distances, rather than to use a reel to wind the extra hose on. When the reel is used the hose is usually ½″ three-ply wire wrapped to prevent kinking and also to serve as a protector to the outside rubber. The best hose to use for reeling purposes is what is known as "brewers' hose," which is heavy and very flexible, but will not kink and will accommodate itself to quite a small radius.

Straight lift hoists are the type most generally used, but they are also constructed so as to hang horizontal where the overhead room is limited and also where it is necessary to have a greater amount of lift than the amount of head room will allow with the straight lift. Bolting an ordinary hoist cylinder to the upright post or pillar of a crane employing sheave pulleys and chain or wire rope is not uncommon practice and such arrangement makes a cheap and effective hoist. A construction of this kind can be used to good advantage for charging foundry cupolas, but where possible it is better to employ the direct-acting hoist.

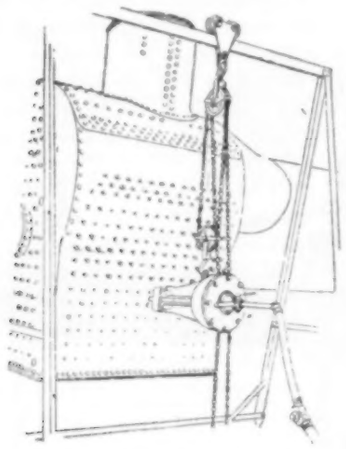
Air as Drilling Power.

Turning iron or steel with a small air jet blowing from a hole about $\frac{1}{16}$″ dia. at the point of contact between the work and the tool has a similar effect to the ordinary method of using water for a smooth finish, but by using the air a higher speed can be taken for the finishing cut, and the finish will be better than by using water, without considering the slop and inconvenience of the latter. Around the drill press the air jet is a valuable aid in drilling holes, particularly when the holes are to be tapped, as the instant the air jet is used the chips at the bottom of the hole find some other resting place, leaving the holes as clean as a whistle, and in erecting machinery the air jet is also employed to great advantage in thoroughly cleaning close fits and bearings before assembling the different parts.

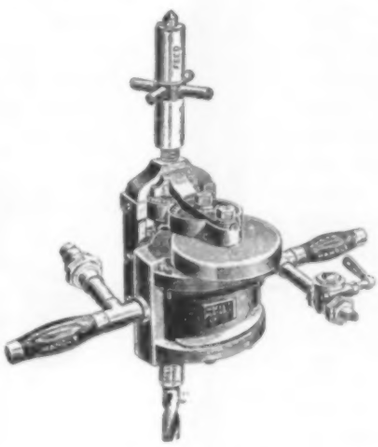
The air jet along the work bench will be found a very satisfactory adjunct in keeping things clean; also, at convenient points along the benches air mingled with gas by means of a simple combination of iron pipe permits of quickly melting babbitt metal or lead, or brazing and soldering can be facilitated.

Shops using portable tools taking power find the little portable engine or air motor a very great labor saver, as it is so very easy to locate and get ready for business by simply connecting the motor to the air line by a hose connection. The exhaust air from various air tools around the shop is more beneficial than otherwise, as it purifies

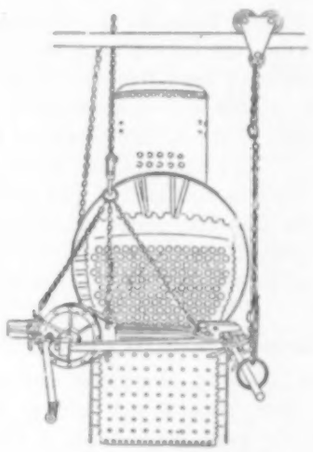
the surrounding atmosphere. It often happens that some special machines around the shop would stand a higher speed on a special job, but it would not pay to increase the driving pulley or alter the belt just for the work in hand; but the available air motor can be run to the machine, a belt attached and be at work driving the machine at any speed desired, in from 10 to 15 minutes' time. Shop men in general look at the breast drill with very little favor, but at the same time it is a tool that cannot be spared from the shop's equipment, as there are lots of small holes in heavy pieces that can be operated upon with the breast drill more quickly than the piece of work could be moved under the drill press. The small pneumatic breast drill of light weight and capable of drilling from the smallest hole to ⅜" dia. is a vast improvement over the ordinary hand tool, as it is very easy to operate and accomplishes vastly more work, besides doing it in a better manner than could be done by the old way. The uses of such a tool can be better appreciated when witnessing it in operation.



STAY-BOLT CUTTER.



PORTABLE DRILL.

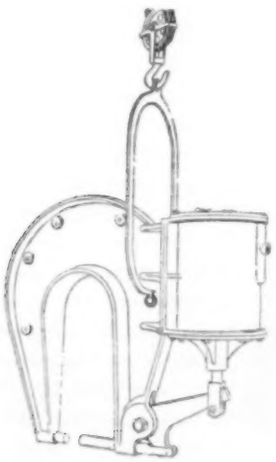


STAY-BOLT BREAKER.

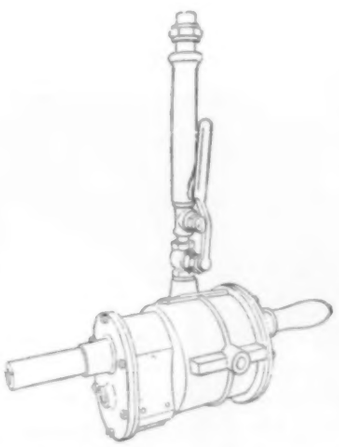
Mandrel Press, Drill and Sand Sifter.

The pneumatic mandrel press is another shop fixture that will bear a better acquaintance and be found a very useful tool, doing away with the sledge hammer and preserving the mandrels, which deserve better treatment than is generally given them. The mandrel press consists of an air cylinder with an auxiliary cylinder placed either on top or at the side of the air cylinder. The auxiliary cylinder is filled with oil, with small holes drilled through the piston head to prevent the press from working too quickly. In operation the work is placed on a support or bracket and the air admitted to the air cylinder, the piston of which moves slowly downward, only as fast as the oil can escape from under the pressure of the oil cylinder piston, making a simple and effective way of forcing mandrels, preventing the filling of the centers with dirt and the bruising of the ends, as is common practice and causes the mandrels to run out of true.

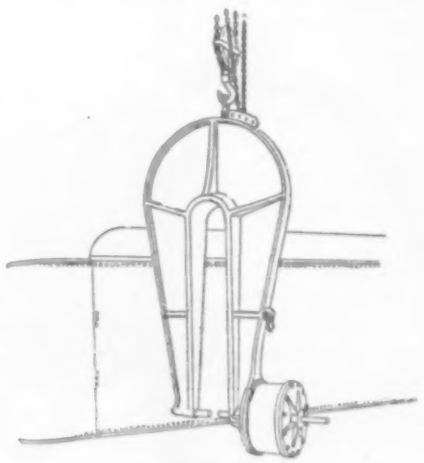
The Phœnix compressed air tool, for drilling, reaming and tapping, has become very useful in the building of bridge, ship, boiler, locomotive and structural iron work. Its saving of labor, as compared with hand work, is so great that the tool pays for itself in a few weeks. Tapping 100 holes for stay bolts in locomotive boiler fire boxes by hand in ten hours is considered a good day's work for one man, but with the little machine referred to that much can be performed in one hour, and it can also be used for screwing the stay bolts in, after the holes have been tapped. The tool is also used for drilling holes in the locomotive boiler during the erection of the locomotive, also for reaming rivet holes in bridge construction work, and for drilling holes in the rails or track of trolley roads for the bond wires.



BRIDGE RIVETER.



TAPPING, SCREWING AND DRILLING MACHINE.



TANK RIVETER.

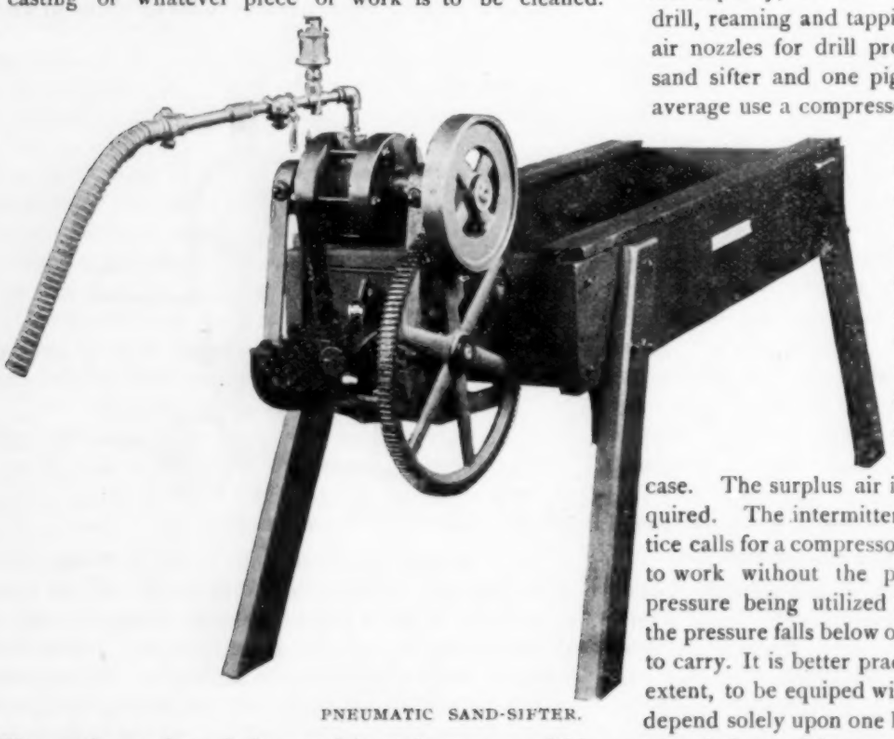
The pneumatic sand sifter fills a want in foundry work. It is a portable machine consisting of the regular riddler or sieve mounted in a heavy wooden frame, and the riddler is driven by a gear in conjunction with a small rotary motor. With this device core sand to be tempered, which ordinarily is extremely slow and laborious to riddle, can be riddled better than by hand and as fast as a workman can shovel it into the sieve. Foundrymen well know how much more easily iron melts if broken into small pieces, with a consequent saving in fuel, but the cost of breaking the iron must not offset the saving so produced. The pneumatic pig iron breaker is so constructed that it will

break into suitable pieces several tons of pig iron in an hour or so with the aid of one laborer. It consists of a cylinder mounted on a frame over the breaking block and is operated by a lever. Pushing the lever to one side raises the hammer and the reverse movement of the lever exhausts the air, quickly bringing the weight down with sufficient energy to break the hardest piece with one blow; the only labor required is to place the pig upon the anvil.

Another pneumatic tool is the caulking and chipping hammer, which permits work within its scope to be greatly facilitated. The succession of hard blows of which the hammer is capable will upset or caulk the joints of boilers or the strake plates of ships very rapidly. The companions of the caulking and chipping tool are the pneumatic riveter and the stay bolt cutter, which are coming into general use as the efficiency of compressed air for shop purposes is more widely known.

The Sand Blast for Cleaning Metals.

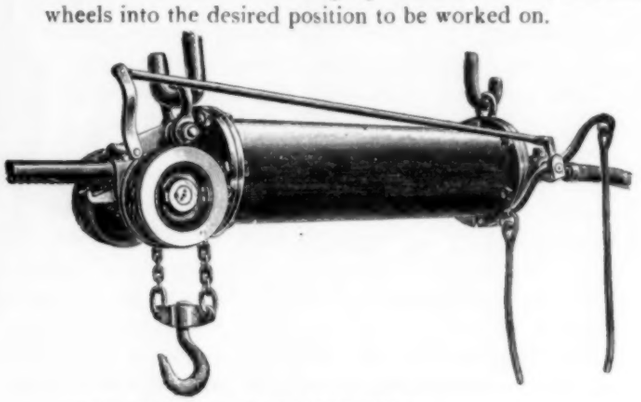
The cleaning of metallic surfaces by the sand blast process is beginning to interest those who have much work of that description to do. The cutting action of the sand is produced by mingling the sand with a low air pressure of about 15 pounds to the square inch, and shooting the sand out of a chilled steel nozzle which is held in the workman's hands. The entire outfit is quite simple, as the machine itself is constructed of sheet iron divided into compartments. The air is admitted, drawing the sand along with it into a rubber hose capped with a hard steel nozzle, and the operator plays the volume of sand against the casting or whatever piece of work is to be cleaned.



PNEUMATIC SAND-SIFTER.

The cutting action of the sand is such as to quickly remove all the scale or dirt, exposing with a beautiful finish the metallic surface in a very quick time, the average capacity being the cleaning of six square feet per minute. The sand blast and its utility for the work mentioned was made manifest by railroad trains running across sandy deserts in the western part of the country, where the wind drove the sand against the window panes of the coaches, cutting the glass so much as to almost destroy its transparency.

A number of the leading railroads of the country use compressed air to drive the sand from the sand bins to the sand chamber of the locomotive; also to force the ends of couplings into air brake hose. The boilers of repaired locomotives are also charged with air and run from the repair shop to the main track or siding, instead of having to tow them out or fire them up when in the shop. The pneumatic jack for raising driving wheels is also a convenient tool in railroad shops. It consists of a cylinder placed below the shop floor with the piston rod made with a forked end, which coming up under the axle, lifts the wheels into the desired position to be worked on.



TWO FORMS OF PNEUMATIC HOIST.

Necessary Capacity of Air Plant.

To use compressed air for the various purposes for which it is so admirably adapted is to become its advocate for many a slow and laborious task now performed by other methods. An air plant of sufficient capacity to supply 20 to 30 air hoists ranging from 1,000 to 20,000 lbs. capacity, one air motor, two breast drills, one rotary drill, reaming and tapping machine, two caulkers, several air nozzles for drill presses, three mandrel presses, one sand sifter and one pig iron breaker, would require average use a compressor with capacity of from 100 to 150 feet of free air per minute. Air hoists require less air than any other air appliance we have mentioned, and the number can be increased to quite an extent without drawing perceptibly on the supply from the compressor. A compressor of capacity stated would not be sufficient to supply all of the tools named if they were all in operation at the same time. In actual practice this is not the case. The surplus air is stored in the receiver until required. The intermittent use of air in ordinary shop practice calls for a compressor automatically controlled in order to work without the presence of an attendant, the air pressure being utilized to start or stop the machine when the pressure falls below or reaches the amount it is desired to carry. It is better practice, where air is used to a large extent, to be equiped with several small machines, than to depend solely upon one large compressor, so that in case of a break down of the compressor the entire installation is not at a standstill until it is repaired. If the compressors are automatic in starting and stopping, they can be so arranged that if one compressor is not sufficient to supply the required amount of air the second machine will start up, acting as an auxiliary to the first.

THE NEW TOOL OF TRANSMISSION.

BY OBERLIN SMITH.

The historians of the future will doubtless record the last twenty years of the nineteenth century as one of the most remarkable eras in our civilization, in regard to the development of the important engineering art of power transmission—and this by an absolutely new method, unthought of in all the preceding centuries. In this broad statement I refer to the transmission of energy by an electric current, rather than by the mechanical appliances heretofore used.

Disregarding in this essay the important functions of electricity in the domains of telegraphy, telephony, electro-plating, together with numerous analogous chemical processes, and also in the even more prominent and important fields of lighting and heating by this universal energy-carrying agent, we will consider merely its functions when acting as a substitute for the kinetic mechanical appliances, which so long have had their important share in the ruling of the world. Before proceeding to analyze in detail the functions referred to, it will be well to impress upon the general reader (and this cannot be done too strongly) the importance of forgetting the mass of misinformation, which is so prevalent in the newspapers, and in pseudo-scientific conversation about the electric current as a new creation of power itself, together with dynamos, and such machines as the producers or creators of energy. There is, perhaps, some excuse for this view of the case among those who have not given it sufficient study, in view of the fact that, from time immemorial, animal muscles, wind mills, water-wheels, and in later years the steam engine, have been considered as generators of power, *per se*. The fact, of course, is that a wind mill or water-wheel merely changes the power already existent in a continuously moving stream of air or water into the rotary or reciprocating motion of a piece of wood or metal, thus putting it in proper shape for its transmission into the various fields of industry where it is to be set to work in its service for mankind.

In regard to the steam engine, there is more excuse for considering it a real generator, because it goes back into the domains of chemical energy, and latent energy at that, as stored in lumps of coal or wood and transmutes this invisible and seemingly non-existent power into actual mechanical motion, visible to all.

A case closely analogous to the steam engine is that of the human or animal muscle-power which seems to be created from almost nothing, but which, of course, is simply the transmuted latent energy existent in the food which supports life.

In the older forms of producing motion by an electric current, somewhat similar phenomena to the above could be observed when the curious vision of electro-mechanical motion appeared in the electrical locomotive of Prof. Henry, or the little electrical passenger boats which were actually run in the early part of the century, with apparently no active source of motive power behind them. To the eye of the chemist, however, who saw his valuable zinc gradually eaten up and digested in the hungry maw of the acid bath forming the fluid of his battery, the case was merely one of the changing of latent chemical energy into active mechanical work, very much on the same general principle of the animal or the steam engine, or at any rate performing an analogous transmogrification.

When, however, it was found that zinc as a fuel was so expensive as to be absolutely impracticable for commercial use, the various motors known to the youthful century were relegated to the domains of the laboratory and the toy-shop. No further serious developments of them occurred until the brilliant discoveries of a few years ago which led to the dynamo as a practical transmuter of any ordinary mechanical power, already existent in a revolving shaft, into the powerful electric currents now so prevalent. These were known to our fathers only as an occasional phenomenon, in the shape, perhaps of an arc light, produced by some bold philosopher lucky enough to possess an enormous number of chemical batteries, harnessed together for a temporary but mighty effort, foreshadowing, as it proved, much future glory.

Doubtless there still remain many men engaged in practical mechanical pursuits, and it is to be feared even some calling themselves civil and mechanical engineers, who regard an electric current as a vaguely mysterious source of power of some kind or another. The electrical engineers, whose especial business it is to understand these things, do, as a matter of course, have a correct idea of the subject, as do, in the present day, most other engineers whose business it has become to deal, directly or indirectly, with the mighty transmitting force which we are considering.

During all the thousands of years that we have been building machinery, back in the mists of obscurity even as far as Hero of Alexandria, and perhaps Tubal Cain himself, we have known the simple principles governing the transmission of power by a reciprocating bar like a pump rod, or a swinging lever like the beam of a steamboat engine or a pump-handle, or by a revolving shaft, or by ropes and belts and chains of various kinds. The distance to which we can transmit by plain lever was always confined to a few feet. With a sliding rod, however, properly supported and especially arranged to pull only and not push, we have attained a transmission through hundreds, or even up to a thousand feet or more, with, of course, a considerable loss in friction, etc. With revolving shafts we have accomplished about as much, although finding it necessary to make them enormously large and heavy, with a consequent waste of power, to prevent too much torsion. With ropes and belts still greater distances have been covered and more and more improvements have been made, until we have reached what perhaps may be called the climax of mechanical transmission in the cable railways which so frequently infest our streets.

These last named mechanisms are, of course, very useful in their way (and in their day, it may be said, perhaps an evanescent one) and are matchless specimens of mechanical skill and of difficulties overcome. Indeed, nothing can well impress an uninitiated observer with a mechanical mind more forcibly than to see several miles of underground cable silently pulling scores of cars up hill and down with each under the perfect control of its driver. The mysterious efficacy of this device was never more graphically described than by the Chinaman upon his first view of a moving cable car, if I may quote such a well-worn criticism, when he remarked: "No horsee, no mulee; no pushee, no pullee; go likee [here he said something badee] allee samee."

Splendid and magnificent as is a full-fledged cable railway, regarded as a mechanical achievement it is well known to have the serious defects of enormous first cost; reasonable efficiency only when working at full, or nearly full, load; incapability of giving a reversed motion to the cars; and the maintenance of a provokingly uniform speed, where great and rapidly attained variations are frequently desired.

In strong contrast to this system of driving cars is that new and marvelous machine, the electric trolley line. Not only is it capable of reaching miles and scores of miles further than possibly could a line of cable, but it has the transcendent merits of: 1st, much cheaper original cost; 2nd, capability of being easily dismantled and removed to a new situation; 3rd, almost equal efficiency with great variation of load; 4th, adaptability to great changes of speed and reversal of direction; 5th, cheapness of maintenance and repairs. The alleged comment upon the trolley car by the Southern gentleman of color, when it made its advent into Georgia, may be too ripe a chestnut to introduce here, but is so good in itself, and so suitable as a companion-piece to the remarks of the Chinaman above quoted, that I venture to repeat it. It ran, I believe, somewhat as follows: "What de mischief will dem da' Yankees do next? Dey come down heah befo' de wa'h and free de niggah, an' now dey come and free de mule."

The electric railway, however, is but one manifestation, although to the public the most apparent one, of the new and wonderful *tool of transmission* which has been put into the hands of the mechanical engineer within the last dozen years. We none of us have the slightest idea what electricity is. We have only learned a few minor points in regard to the way it behaves, regarding it in the abstract. As far as we have gone we have learned to control and regulate with wonderful precision such currents as we have learned how to generate. In what other forms we may in future be able to use this all-pervading manifestation of the energy of nature we have as yet but little conception. Such profound philosophers as the lamented Hertz and the still young and vigorous Tesla have been groping their way into the misty darkness that lies before us, and have evolved certain brilliant facts which may yet produce a revolution in our methods of dealing with all natural forces. Thousands of others are feeling and searching, trying to learn the true inwardness of electric science. Occasionally a glimmer of light appears, but the two most prominent problems which we are all trying to solve still elude us.

These problems are, firstly, how to use the electricity we have, which is probably produced on an average with a loss of about 90 per cent. of the energy existent in the coal from which we derive so much of it, without losing another 80 per cent. or 90 per cent. in turning it into light. When we turn this 10 per cent. balance back into mechanical power, however, we have succeeded with our electric motors in getting the very satisfactory efficiency of over 90 per cent., thus leaving us about 9 per cent. of the original. Indeed, one of the most remarkable things about the lightning-like development of the art of making and using modern electricity, is the great simplicity and high efficiency of both dynamos and motors, each of them, when made of reasonably large size and of the best design, not losing not more than 10 per cent. in the transmutation of power into current, and of current into power, respectively. Thus in power transmission (generating by steam) without counting the line wires to be long enough for perceptible "drop," our total losses need not necessarily be much over 90 and 20 per cent., or a total of 92 per cent. In lighting, they may amount to 99 per cent. or so.

The second problem referred to is, how to turn the energy of the coal directly into electric current without the great complication and seemingly foolish waste of the steam engine. This will probably be done some time, and no one knows how soon it may be sprung upon the world. Whether it will be by caloric, or by purely chemical methods, we know not. If, however, machines for performing this transmutation shall ever be made with the 90 per cent. efficiency, which we have already attained in the dynamo and motor, it will mean that the ten tons of coal from which we now get the energy due to one ton, will give us the full energy latent in nine tons. Should this ideal machine be as comparatively simple as are the other electrical devices referred to, the labor cost of attendance would also be vastly lessened as compared with steam boilers and engines, with their paraphernalia of steam pumps, condensers, etc., and the cost of the power, which in its effect upon civilization is indeed Power, in more senses than one, will be decreased to about one-ninth of its present rate. Conversely, for the present cost the dynamic force which is so large a factor in our progress and happiness will be increased to an extent approaching this nine-fold ratio.

Though, as before said, we cannot tell what this electric current is, we do know that with it we have a marvelously powerful and simple push rod, as it were—a rod which we can push at one end and which will give out nearly all the force we apply to it at the other end. After this similitude (to give a homely illustration) would be a long row of bricks set on end and properly spaced, which, when the first one is upset, transmits a wave of tumble-down-ativeness, so to speak, along the entire line, the last one falling with the same force as the first. Modern engineering has acquired within the last decade or two this fairy-like wand, with which we can touch distant objects and instantly inspire them with the transmitted energy of the sun. We have, however, something far more fascinating than simply a rod reaching any desired distance, which naturally might be supposed to extend in a straight line, and to require strength enough to resist the number of pounds pressure imposed upon it at the starting end. Even were it subject to these conditions it would be an ideal instrument such as a few years ago none of us could have anticipated, but it fortunately has none of the limitations described. A small wire, costing in itself but a few hundred dollars a mile, running in any direction and with any amount of crookedness, sunk beneath the ground, or strung high in the air, will convey hundreds of horse-power, and will last through indefinite time without repairs or lubrication, and, if properly guarded, with no expense for maintenance. More than this, it can branch and re-branch its arms in any direction, dividing the power conveyed by it into an indefinite number of small units, and each of these units perfectly controllable.

In speaking of thus running one wire, I intend to give an illustration of a case where a ground return circuit can be used. In practice, it is well known that two wires are generally used, the second one for the return circuit, to avoid any conflict arising from interference with other power circuits, or those belonging to electric lights, telephones, telegraphs, etc. Furthermore, in speaking of a small, cheap wire for conveying large amounts of power, it is assumed that the conditions are such that a high voltage can be used. It will not be within the scope of this essay to here dilate upon the various methods employed and the comparative advantages of continuous currents with commutators on the dydamos and motors, or of alternating currents with transformers, and with commutatorless machines. Neither is it necessary here to dwell upon the probable advantages of multi-phase currents, as the methods of using them shall become further developed.

It is, perhaps, enough for us to know and realize during the remainder of this century that we have already acquired the wonderful tool in question, and to learn further how to apply it economically to the driving of machinery distant from the source of power upon which it depends for its operation. Not only is power thus transmitted so evenly divided and controlled that it pays to run a current from Niagara to Buffalo (or perhaps even to Albany and New York), or from the coal fields and gas wells, to any great city within fifty miles or so, but it has already been shown by actual experience that there is in many cases economy in mounting a dynamo armature upon the shaft of a large engine which drives a factory, running wires therefrom to the various buildings, rooms, and even individually to the machines themselves. Such an engine to the unsophisticated pre-historic mechanician of twenty years ago would seem to be doing absolutely nothing. Such machines to the same ancient engineer would appear to be driven by nothing, all the same as the Chinaman's street car.

The fact remains that, although we are yet working in a crude way, with but comparatively little knowledge of just what we want to do, there are already in every large city thousands of motors running which are driven from a central distant source. Furthermore, in numerous great mills pulsations of energy from the power generator are being sent out in many ramifications throughout the plant, so as to bring it exactly *where* it is wanted to be used, only *when* it is wanted, the respective motors drawing from the potent wires the exact amount of this energy that at any particular moment can be properly used without squandering it in the horrible way incident to our old-fashioned transmission tools, shafting, gearing and belting. This power when so brought to a machine is not only latent except while it is required, and in the exact amount needed, but is almost infinitely controllable by the simplest means.

This statement will not seem at all strange to anyone who has had experience in running a lathe, or drilling machine, or punching press, by the simple moving of a controller switch instead of by the more complicated ancient means of splined-shafts, change-gears, belted cone pulleys, etc.

Just how far the use of individual motors, attached to each and every machine, rather than to lines of shafting to which such machines are belted, will be used in the future, is a question that still remains unsettled. In the writer's opinion, however, such appliances are destined in the near future to have a marvelous development, as the advantages, even assuming that on the whole there is no very great saving of power, are manifest in many ways. Not only do these appear in great convenience of manipulation, but in cleanliness, safety, attainability of quick variations and reversals of speed, but in the additional light and space obtainable over a room full of machines. This is valuable not only for the handling of work in general, but for the running of travelling cranes (presumably electric) over machines which now cannot well be served with their supply of material in this way.

The only hindrance at present to the instalment of this system in the majority of our new factories is the great cost of small motors. This difficulty will in time remedy itself as the manufacture of these machines becomes systematized, so that proper special tools can be used and large quantities made at a time. As the demand increases, so will the supply, and, per contra, as the supply is augmented with its cheapening of price, so will the demand most wonderfully increase.

WASTE IN FOUNDRIES.

BY A. SORGE, JR., M. E.

A wasteful process is one which involves the consumption of more material or labor than necessary for the accomplishment of the desired object.

An economical process is one in which no surplus material is employed and in which all labor or effort produces the greatest possible result. The distinction between the two in modern foundry practice is not always apparent to the superficial observer. Self-evident and glaring examples are only to be found in plants where the ruling powers are either narrow-minded and fossilized, or where the foundry forms only an auxiliary department whose results and product do not enter into the calculation as furnishing marketable goods. But even in such cases obvious waste is checked sooner or later. Apparently insignificant and trifling matters frequently amount to considerable in the aggregate, and escape attention. To give a full list of such would be impossible, as they depend largely upon the equipment and practice of the particular foundry. But the subject is one which deserves careful study, as the stoppage of these small wastes or their continuance may occasionally make the difference between profit and loss. I have already called attention to some of the advantages of keeping in good order the foundry yard and the materials stored there. All who have had experience in such matters will agree that disorder and slovenliness in the yard involve the waste of considerable labor and frequently the destruction and waste of material.

Where steam is employed around a foundry, all joints should be kept tight, and the valves, cylinders and stuffing boxes of steam cylinders should be carefully inspected periodically. To illustrate the wastefulness of allowing leaks in any such parts, let us assume that an opening exists equal to a hole ⅛ in. square, and that the steam-pressure employed is 75 lbs. This will permit the escape of 1.22 lbs. in weight of steam per minute or 732 lbs. in weight of evaporated water in ten hours. This is equal to 846 lbs. of water evaporated from and at 212 degrees F. With good setting and fuel, as well as careful firing, an ordinary boiler will evaporate 8 lbs. water per lb. of coal from and at 212 degrees F. Therefore, this small leak has consumed during ten hours 106 lbs. of coal, which amounts to 16c daily at $3.00 per ton or $48.00 per year. It is not unusual to see several such leaks which are neglected on account of their apparent insignificance. Again, it is quite common to see steam pipes without proper covering. At 75 lbs. pressure the temperature of steam is 320 degrees F. The condensation per square foot of surface of ordinary black pipe at this temperature, assuming the surrounding atmosphere to be at 62 degrees F., will be about .77 lbs. per hour. Assuming an ordinary 2-inch steam pipe 40 feet long, to be uncovered, we have a surface of 23⅓ square feet exposed or a condensation of 18 lbs. per hour or 180 lbs. in 10 hours. The loss in this case, if the condensation is returned to the boiler through a heater or otherwise, will be the latent heat of evaporation or about the same as the amount needed to evaporate water from and at 212 degrees F. Therefore, the fuel wasted will be 22⅔ lbs., worth 3⅜ cts. daily or $10.13 yearly. The proper covering of pipes will also frequently prevent losses due to freezing and splitting, and should be as carefully looked after for water as for steam. Leaks in water connections or open faucets are frequent and very wasteful. Without figuring on the fuel cost, where water is used under pressure, let us again assume a not uncommon leak through a hole ⅛ inch square, the hydrant

REPRESENTATIVES OF MACHINERY MANUFACTURING FIRMS OF THE UNITED STATES.

1, F. A. PRATT. 2, ULRICH EBERHARDT. 3 CHAS. A. MOORE. 4, C. A. CLARKE. 5, D. W. PEDRICK. 6, AMOS H. BRAINARD. 7, ADNA BROWN. 8, CHAS. DAVIS. 9, AMOS WHITNEY. 10, P. E. MONTANUS. 11, GEO. A. HADLEY. 12, A. D. QUINT. 13, JAMES HARTNESS. 14, FRED. A. GEIER. 15. F. KEMPSMITH. 16. F. B. SHUSTER. 17, OBERLIN SMITH. 18, J. D. COX, JR. 19, J. L. CHAPMAN. 20, W. D. WOOLSON.

pressure being 20 lbs. This will permit the discharge of 346 cubit feet in 24 hours. At ordinary meter rates for water in Chicago this amounts to $10.10 per year, or if three such leaks exist, to $30.30. Waste due to the above causes is, of course, not exclusively located in foundries, but is frequent enough in them to warrant calling serious attention to same. There are, however, numerous causes of waste that are characteristic of the foundry. First and foremost among these is very often the lack of facilities for weighing. The materials charged in the cupola are only too often proportioned by guess or by measures that are filled differently by different persons at d fferent times. This frequently causes the production of castings that are not fit for the requirements made of them, and are, therefore, rejected. Such losses are wasteful, as they can be avoided by proper appliances and care. This subject has frequently been discussed and emphasized, and I will, therefore, not amplify it. But there are other parts of the foundry where scales and accurate measures should play an important part, but are often neglected. In the core-room the work is only too frequently done by guess. The ingredients which are used for making cores must vary in their relative proportions according to the size of the cores and the special object to be accomplished by them. There is a great difference in properly made cores for work of various thicknesses. But only too often do we find that the core-maker mixes these ingredients by the rule of "that's about right." When such cores fail to fulfill their object properly and cause the loss of the casting or largely increased labor in finishing same, the method employed is a wasteful one in two senses. Primarily, on account of the loss of the castings, and secondly, on account of the waste of the core material. In this connection it is well to call attention to the frequent waste of material in core-ovens due to burning cores or not baking them sufficiently, even where the oven is properly constructed. This can be easily avoided by using appropriate regulating devices.

In the moulding room proper the close observer will often see wasteful methods of apparently small magnitude, but he will see them repeated so frequently that the sum of their effects becomes a serious item. Let us consider a few of these. Here, as in the yard, disorder is bound to create waste not only in material, but largely in labor, on account of the necessity of handling repeatedly what should be done in one operation. Bad arrangement, even when good order prevails, leads to great waste. The foundry should be so designed and built that the material keeps moving in one direction from the time when the flask is placed on the floor or bench until the finished and cleaned casting leaves the establishment. Such arrangement depends upon the character of work produced and can only be decided upon by careful consideration in each case. Still, the general rule above enunciated holds true, and labor is largely wasted whenever the rule is not followed.

Among the smaller causes of waste may be mentioned the carelessness of permitting wooden flasks to get afire and burn after a mould has been cast. Without going into the question of the economy of using wooden flasks, we frequently find that their life is very much shortened by this cause, and the aggregate annual cost of repairs and replacements due to this is quite a large item.

An example of wasteful practice is frequently to be found in the appliances and method of pouring castings. Here we find geared ladles not properly balanced or with the gearing out of order, causing iron to spill and endangering those around. Basins are frequently not provided above the gates, and when provided are often too small to permit the casting to be poured fast enough, besides causing the molten iron to be spilt. Gaggers, chaplets and anchors are not carefully sorted out of the burnt sand, and are thrown away. Flour is carelessly spilt or allowed to remain exposed to the attacks of rats, etc., etc. All these causes and numerous others are responsible for waste whose sum total is frequently large, but difficult to determine in detail.

As stated at the beginning of this article, it is not possible to enumerate all the causes of waste; but the preventive is the intelligent systematizing of the work, together with keeping in proper order the materials and equipment provided. I have not attempted to criticize such equipment, although there is much to be said on the subject.

A GROUP OF MACHINERY MANUFACTURERS.

On page 30 we present the faces of a score of manufacturers of machine tools and machinery specialties, representing various sections of the country, particularly the East and the Central West. As the East is the home of the oldest establishments in most of these lines, the New England States being the tool-making hive of the country, that section is naturally most prominent in our gallery. The following are the names and connections of the manufacturers whose portraits we give, following the order in which they are numbered on the plate:

F. A. Pratt, president of the Pratt & Whitney Co., Hartford, Conn.; Ulrich Eberhardt, of Gould & Eberhardt, Newark, N. J.; Chas. A. Moore, of Manning, Maxwell & Moore, New York; C. A. Clarke, of Hill, Clarke & Co., Boston; D. W. Pedrick, superintendent Pedrick & Ayer Co., Philadelphia; Amos H. Brainard, general superintendent and manager Brainard Milling Machine Co., Hyde Park, Mass.; Hon. Adna Brown, president Jones & Lamson Machine Co., Springfield, Vt.; Charles Davis, president Lodge & Davis Machine Tool Co., Cincinnati; Amos Whitney, vice-president and superintendent Pratt & Whitney Co, Hartford, Conn.; P. E. Montanus, president the Springfield Machine Tool Co., Springfield, O.; Geo. A. Hadley, secretary and treasurer the Diamond Machine Co., Providence, R. I.; A. D. Quint, Hartford, Conn.; Jas. Hartness, manager Jones & Lamson Machine Co., Springfield, Vt.; Fred A. Geier, secretary and treasurer Cincinnati Milling Machine Co., Cincinnati; F. Kempsmith, president Kempsmith Machine Tool Co., Milwaukee; F. B. Shuster, proprietor John Adt & Son's Works, New Haven, Conn.; Oberlin Smith, president Ferracute Machine Co., Bridgeton, N. J.; J. D. Cox, Jr., Cleveland Twist Drill Co., Cleveland; J. L. Chapman, superintendent and treasurer Fitchburg Machine Works, Fitchburg, Mass.; W. D. Woolson, treasurer Jones & Lamson Machine Co., Springfield, Vt.

Steam Shovel Work on the Mesabi Range.

The impossibility of getting vessels as needed made the steam shovel work at most of the open-pit properties on the Mesabi Range quite irregular the past season. While noteworthy records were made on single days the season's performance was not what is likely to be shown another year, with better transportation arrangements. At the Mahoning Ore Co.'s property, near Hibbing, the record for last August, working with a heavy Bucyrus shovel, without preliminary blasting, was 54,250 tons of ore in 25 days of 10 hours each. From July 5 to October 1, which was the shipping period for this mine, 117,885 tons were loaded, working only by day, and with a great deal of lost time.

MOST MODERN OF CHARCOAL FURNACES.

In its first issue of 1895, *The Iron Trade Review* gave the history of the Pioneer charcoal iron furnaces at Negaunee, Mich., with an outline of the plans of the Cleveland-Cliffs Iron Co. for the third Pioneer furnace, to be erected at Gladstone, Mich. We take pleasure in presenting now a description and views of the nearly completed furnace, charcoal and chemical plants, which are soon to be put in operation. The advantages of the site chosen were indicated in the previous article, with which was given a map of the Gladstone district, showing the island on which the completed plant now stands. The island is on Little Bay de Noquette, one and a half miles from the center of the city of Gladstone. The Minneapolis, St. Paul & Sault Ste Marie Railway runs along the shore of the main land opposite the island, and the railroad connection leading therefrom crosses the intervening bayou on an embankment. The harbor is perfectly landlocked and the 150′ x 600′ dock of the furnace company permits of the ready shipment of product with the least handling. The dock is at the foot of the cast house and affords ample space for the storage of iron. It is accessible to boats drawing 17 feet of water. The design of the plant had in view the reception of crude material on the land side; the product is turned out on the water front, ready for loading into boats or for shipment by rail.

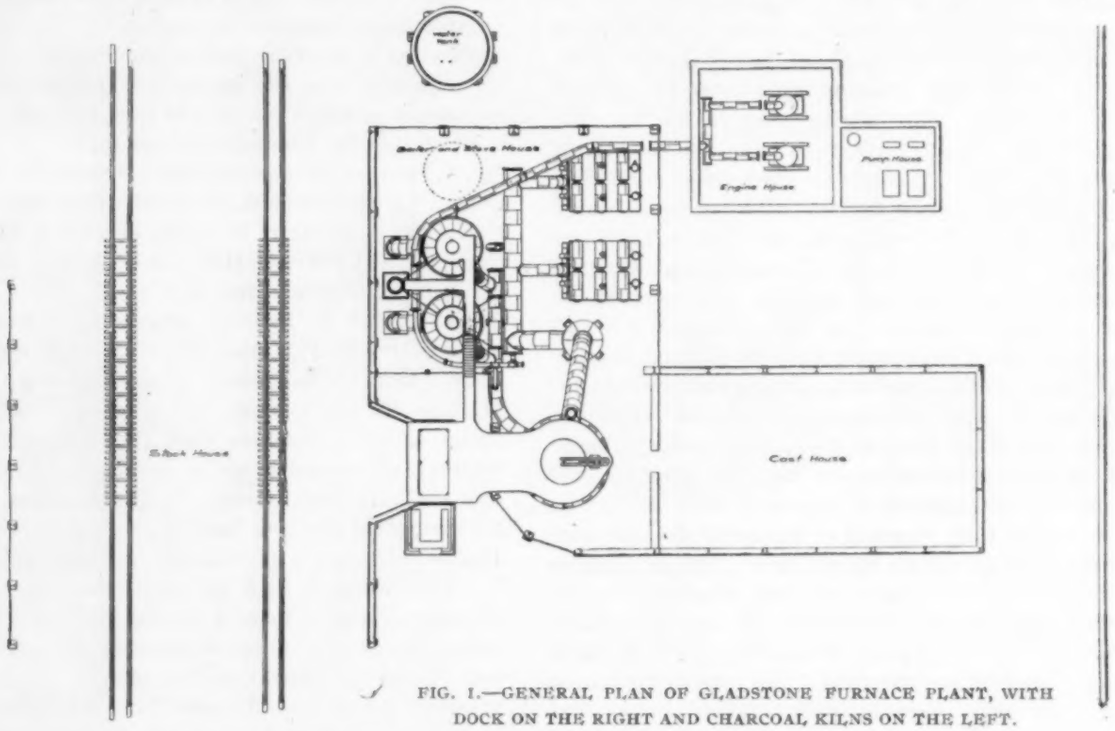


FIG. 1.—GENERAL PLAN OF GLADSTONE FURNACE PLANT, WITH DOCK ON THE RIGHT AND CHARCOAL KILNS ON THE LEFT.

Construction work was begun May 1st of this year and at this writing the furnace stands complete. One or two of the accompanying views were taken while work on the stack was still under way, but they give a very good idea of the arrangement of the plant and the facilities for the economical handling of material. Taking into consideration the isolated location of the furnace and the great distance from the base of supplies, together with the inclement weather encountered in the upper lake region after October 1st, remarkably good time has been made in the work of construction.

The Blast Furnace Plant.

The blast furnace was built under the designs and supervision of Frank C. Roberts & Co., engineers, of Philadelphia. E. C. Brown, their representative on the ground, was in immediate charge of the construction. Much care and attention have been devoted to the design of this plant, both in general and detail, and the excellent results attained are due not only to the engineers, but to the careful study of the conditions by President W. G. Mather, of the Cleveland-Cliffs Iron Co., and the untiring efforts and practical ideas of Manager Austin Farrell, whose aim has been to embody, as far as possible, all the latest improvements in furnace practice. Of the illustrations, Fig. 1 is a general plan of the furnace plant alone, from which the relative arrangement of the various parts may be noted. The dimensions of the furnace are as follows: Bosh, 12′; height, 60′; hearth, 7′; stock line, 8′, and bell, 5′. Fig. 2 shows a sectional elevation of the furnace. The furnace is equipped with five tuyeres and five rows of Gayley bronze bosh plates. The hearth jacket is built of one-inch steel plates designed to be cooled by a water spray on the outside. The bell is operated by a steam cylinder, the operating mechanicism being such that the movement of the bell is entirely in a vertical line.

Fig. 2 also shows a section of the dust-catcher. The theory of this design is that by gradually increasing the diameter of the continuation of the down-comer downward, from the point at which it enters the dust-catcher, the speed of the gases decreases while the speed of the particles of dirt increases owing to the acceleration of gravity. The annular area between the bottom of the inside pipe and the dust-catcher proper is approximately four times that of the down-comer, whereby the speed of the gases in passing upwards in the dust-catcher is about one-fourth that in the down-comer. In consequence of these conditions a large portion of the dirt carried by these gases is deposited in the dust-catcher.

The stove plant consists of two 16 x 70 Cowper stoves, lined with Roberts brick, space being left for a third stove. Figs. 3, 4, 5 and 6 show respectively a sectional elevation of the stove, a plan giving a half plan at the bottom and middle of the stove and shape and method of laying up the brick. These brick are so made and laid that they interlock with each other. The design is such that no contact takes place between adjacent brick at the point

A (fig. 6), a condition which insures close contact between adjacent bricks at the points B and C. The clearance at D (fig. 6) is provided in order that no weight of superposed brick work shall rest on the projections at the ends of each brick. The bricks are three inches in thickness and the flue openings nine inches square. Each stove has 16,900 square feet of heating surface.

The boiler plant consists of four Stirling boilers set in two batteries. These have a total heating surface of 5,750 square feet. An independent chimney is provided for each boiler. There are two vertical blowing engines, formerly in use at the company's furnace plant at Negaunee, Mich., which has been dismantled. One is of the Weimer and one of the Hemphill type, and either will be sufficient to furnish the blast for an output of 100 to 130 tons of pig iron daily.

The air piping system is as complete as possible. The cold blast main is 30″ diameter and the hot blast main 44″ diameter, lined to a clear diameter of 25″. The bustle pipe is 37″ diameter, lined to a clear diameter of 18″. An equalizing pipe is provided between the cold and hot blast pipes. The gas main consists of one pipe only running between the stoves and boilers, with branches leading to each.

Water is taken from Lake Michigan by a suction pipe extending some distance into the lake. Two Worthington pumps of ample capacity control the circulating water system, discharging the water into an elevated tank from which it is distributed to the furnace, stoves, etc. The pig bed is served by two spray pipes, one on each side of the casting house, these pipes being of the same character as those employed at the Warwick Furnace, at Pottstown, Pa. The waste water as well as the rain water from the buildings is conducted to the lake by an efficient system of sewers.

The boiler feed is controlled by two Knowles pumps, the water being delivered to boilers through a heater connected to engines and pumps. A pipe also leads from these pumps whereby water under high pressure can be delivered to the various parts of the plant.

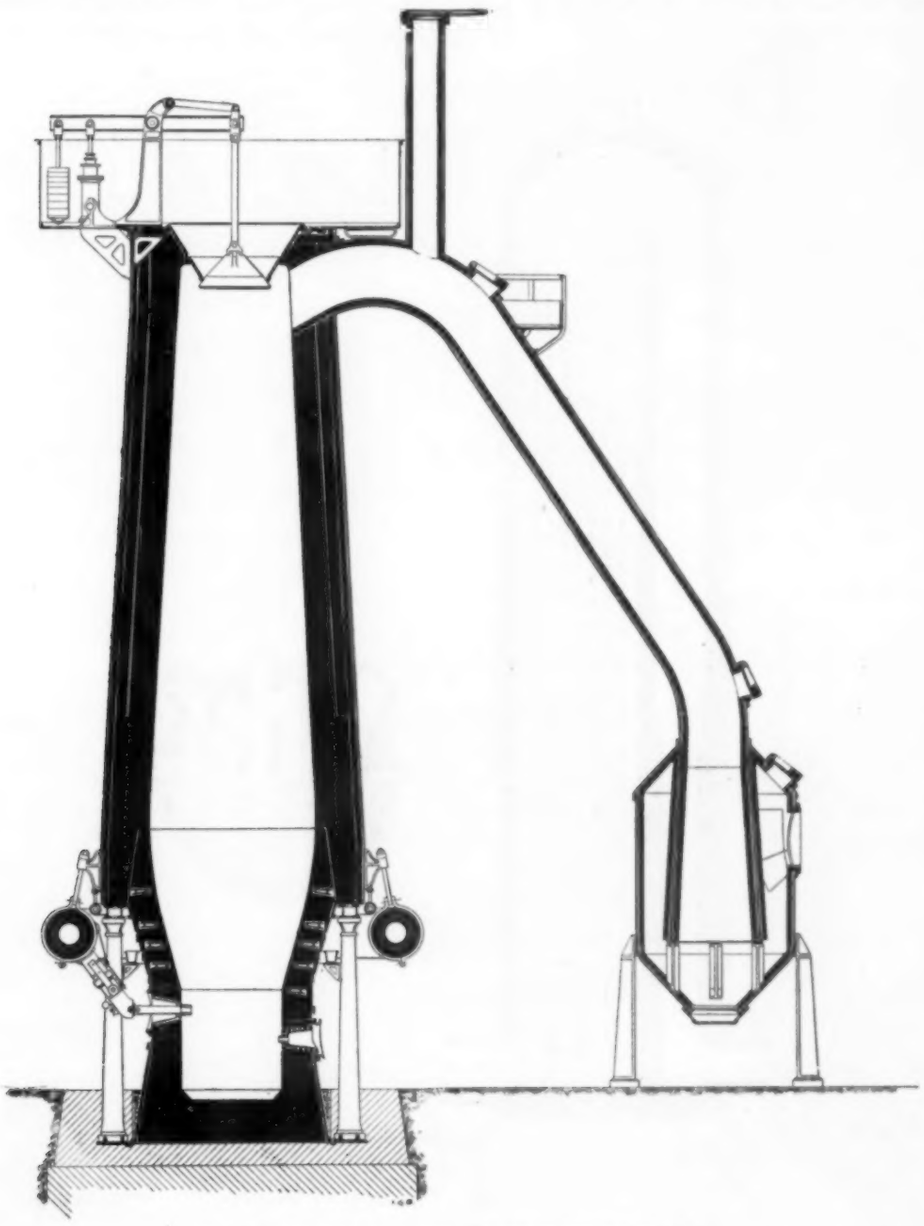


FIG. 2.—SECTION OF FURNACE AND DUST-CATCHER.

The hoist tower is built of steel framework covered with corrugated iron and is equipped with a new Crane hoisting engine.

All buildings are enclosed on account of the severe winter weather prevalent in Michigan. The stock house, boiler and stove house and casting house are all connected together so that it is possible to pass from one to the other without going out of doors. The casting house is a steel structural building 50′ span and 115′ 2″ long from the center of the furnace. It is covered with corrugated

iron both on the roof and sides, and all openings are provided with sliding doors.

The boilers and lower part of the stoves are placed in one building 78′ span and 88′ 9″ long. This building is of steel covered with corrugated iron roof and sides and all openings are provided with sliding doors. The stock house is a steel structural building 100′ square.

The engine house is a brick building 41′ square and the pump house connected thereto is 25′ span and 27′ long. Both buildings have heavy wooden roofs.

The railroad system is very complete. Ample trestle room is provided for the storage of materials and the connections between the various tracks are such as to give convenient switching facilities.

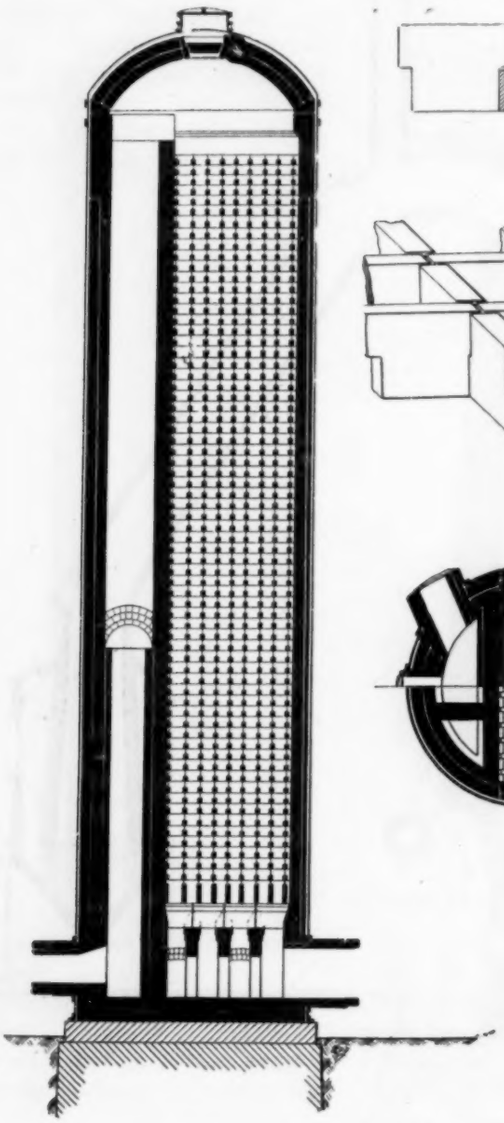


FIG. 3.—COWPER STOVE WITH SPECIAL BRICK.

The Charcoal Kilns.

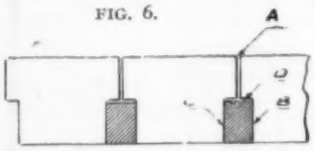
The furnace will obtain its supply of charcoal chiefly from a battery of kilns located directly back of the stock house. The battery contains forty 65-cord kilns, requiring for daily consumption 120 cords of wood. This large supply of hardwood is obtained from the company's lands, about 30 miles east of Gladstone, on the line of the Minneapolis, St. Paul & Sault Ste. Marie Railway, where there is a tract of 8,500 acres. In addition, the company owns in fee, tributary to the furnace, about 12,000 acres of finely wooded land in other directions.

The charcoal kilns are of the following dimensions: Outside diameter of base, 31′; outside diameter at skewback, 27′; height to skewback, 14′. Great care has been exercised to secure the best material and workmanship in the construction of these kilns, and it is calculated that the cost for maintaining them for a term of years will be almost zero.

The Chemical Plant.

So many prejudicial influences have operated against the manufacture of charcoal iron during the past few years, that progressive men in this branch of iron industry find it a necessity to make use of the valuable smoke or gases produced in the process of carbonizing or coaling their hardwood. These gases are secured by a forced draft, which brings them in contact with condensing surfaces of copper, and it will be a revelation to the average reader to know that no less than 200 gallons of pyroligneous acid are secured from the gases of one cord of wood. The process as now conducted has long since passed the experimental period, and manufacturers erect and conduct a chemical plant as an adjunct to a charcoal blast furnace with as much certainty of its being a commercial success as when they build a saw mill.

FIG. 6.



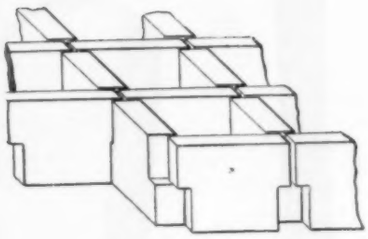


FIG. 5.

FIG. 4

The process of securing methol alcohol and other by-products from the distillation of wood was first conducted in Southern France, where small quantities of wood were placed in a retort and carbonized by the consumption of external fuel. This process is also in operation in our Eastern States, but its charcoal product is limited, is over-

cooked, and is principally used for domestic purposes.

Only at Gladstone and one or two other places, which centralize their charcoal operations and carbonize an immense quantity of wood at one point, can chemical plants be made a success by the process with which we are now dealing.

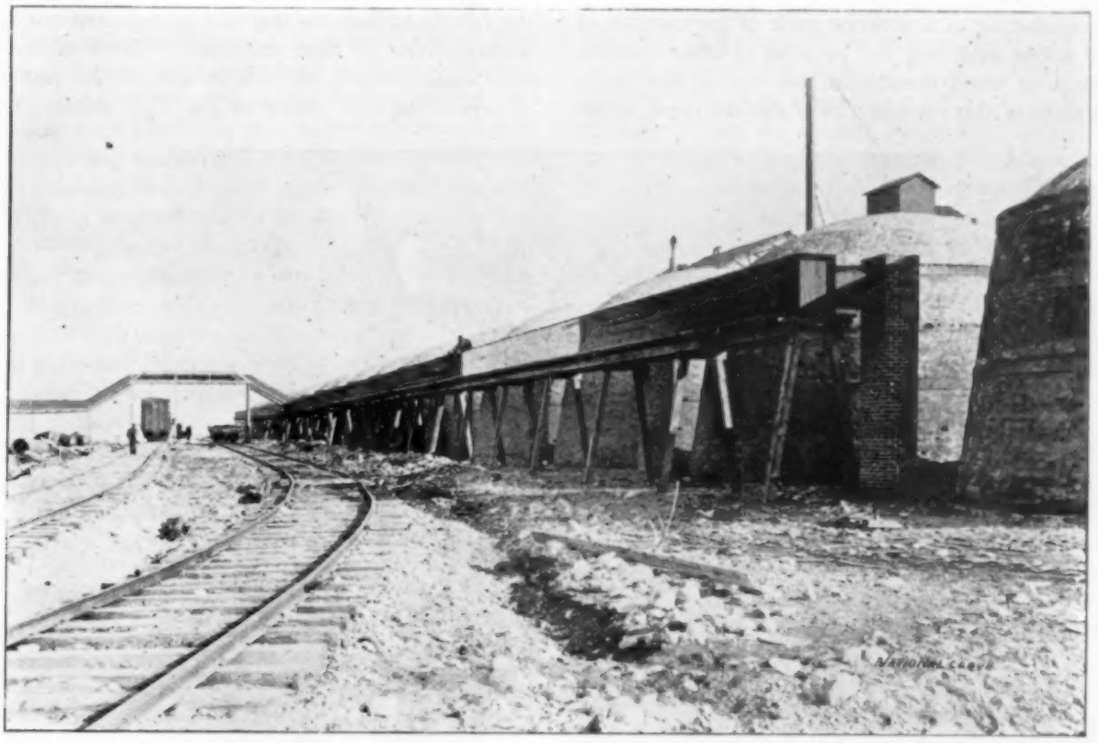


FIG. 7.—SHOWING SMOKE FLUE AND CHIMNEY CONNECTIONS WITH KILNS.

Taking advantage of the conditions referred to above, the Cleveland-Cliffs Iron Co. has erected a chemical plant of the largest proportions in connection with the furnace plant, and every resource has been exhausted for combining the best results of years of expensive experiment.

A gas flue 2,000 feet long conveys the gases from the kiln to the chemical works, where they are first condensed, and then by a system for separating the tar by gravity, and eliminating the water by fractional distillation, a finished product of the finest water-white, deodorized wood alcohol will be produced.

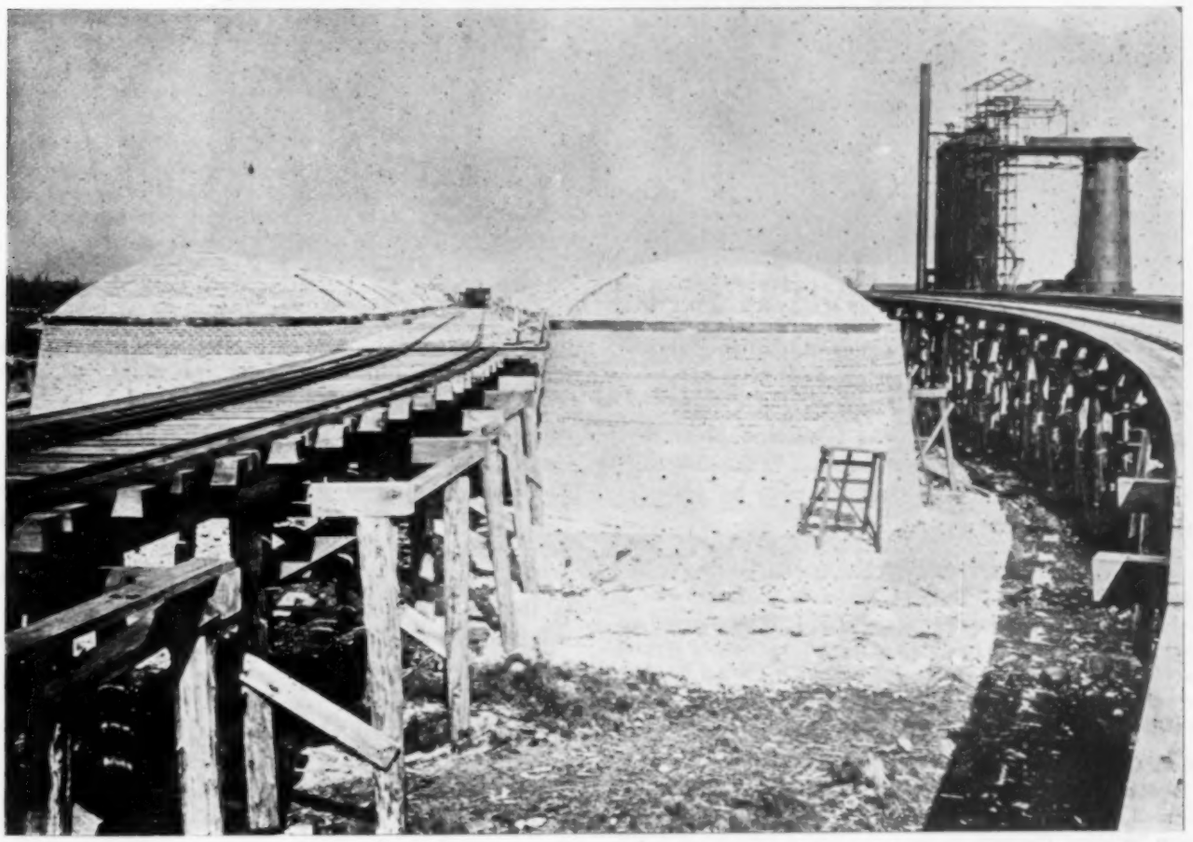


FIG. 8.—BATTERY OF 40 CHARCOAL KILNS.

The buildings of this plant consist of a combined fan

house, engine house, and boiler house, which is 66′ x 66′, separated from the alcohol house by an alley of 20 feet. The alcohol house is 140′ long and 56′ wide, and two stories high.

The manufacture of a superior grade of grey acetate of lime and acetic acid, and the securing of other valuable by-products of wood distillation are among the undeveloped plans of this company, as is also the construction

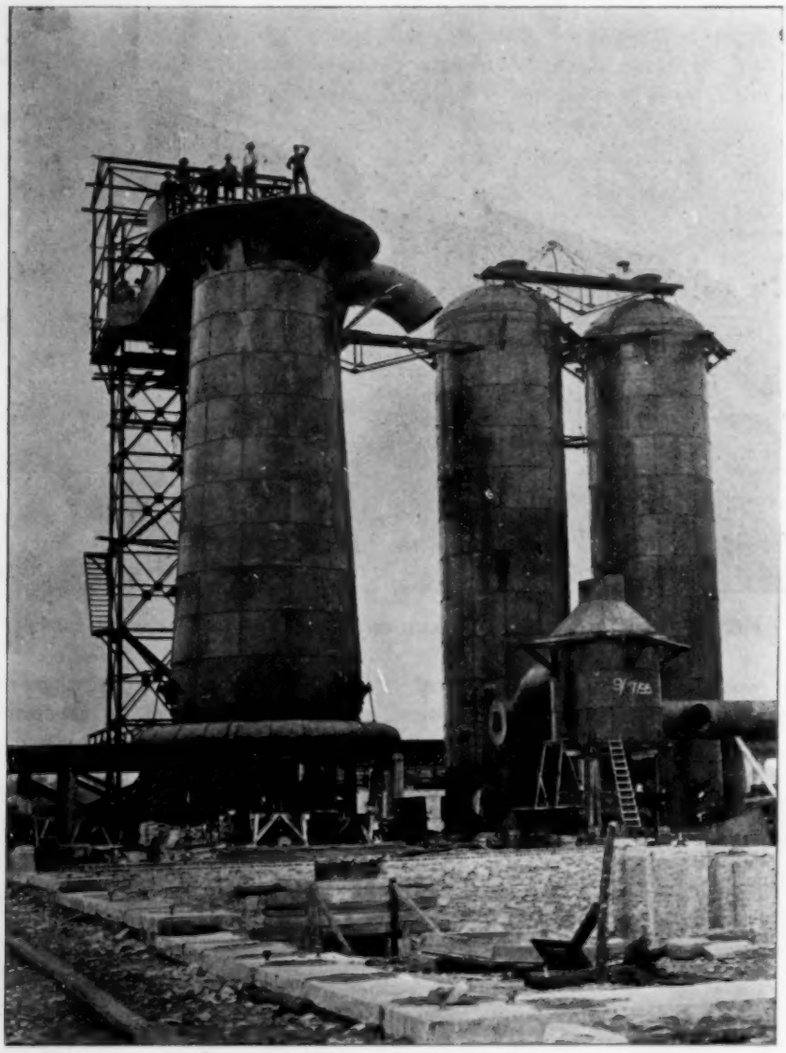


FIG. 9.—FURNACE STACK AND STOVES. THEY HAVE SINCE BEEN COMPLETED.

of a saw mill to utilize the large amount of timber owned by the company, too valuable for use as charcoal.

The Cleveland-Cliffs Co. has also erected a large machine shop in connection with the Gladstone plant, supplied with the most modern tools to assist in the construction and maintenance of the plant. It will be possible, also, to do a large amount of work for others.

THE BROWN-BONNELL IRON CO., Chas. H. Hawkins, agent, 205 Western Union Building, Chicago, has just sent out its annual reminder to the trade, in the shape of a daily memorandum calendar. Mr. Hawkins has been sending these out for several years, until a Brown-Bonnell calendar has become a familiar and very useful part of nearly every iron man's desk equipment.

SO MANY firms send out calendars every year that a choice of one or two to be kept for use must necessarily be made. The wall calendar just issued by the Sargent Co., Western Union Building, Chicago, is very prettily gotten up, and will undoubtedly be retained by most of those to whom it is sent. Above the calendar proper are shown well executed half-tone illustrations of the Sargent Co.'s brake shoes, and cars and a locomotive in which they are used.

IMPLEMENT MANUFACTURERS AS BUYERS.

There is not a little interest in the iron trade, particularly among merchant iron and steel mills and plate mills, as to the volume of business that may be expected in 1896 from manufacturers of farm machinery. Some of the implement makers made contracts in the fall for part of their requirements, but owing to the high prices prevailing there has been a disposition to hold off, and many contracts ordinarily made in the fall are still to be placed. As to the outlook for this industry, we have the opinion below of one of its leading representatives, Col. A. L. Conger, president of the Whitman & Barnes Mfg. Co., which has works at West Pullman, Ill.; Akron, O.; Syracuse, N. Y., and St. Catherines, Ont. Col. Conger has been president in the past two years of the National Association of farm machinery manufacturers, and is a careful student of the commercial and industrial situation. It will be noted that his opinion is not only hopeful but quite optimistic:

TO THE EDITOR OF THE IRON TRADE REVIEW:

"From present indications, the agricultural implement trade for 1896 will show marked improvement over the trade of 1895. The great depression in business following the panic of 1893, coupled with the extraordinary drought of the past two seasons, has worked great hardship to agriculture. This has seriously affected all kinds of cereals, and has brought corresponding depression to the agricultural implement trade. Our experience teaches

us that we seldom, if ever, experience three consecutive dry seasons.

"The manufacturers of agricultural implements, owing to the general situation and unfavorable outlook for crops, were extremely conservative in the past year's build of all kinds of agricultural machines. As a consequence, there was a general clean-up of agricultural machinery on hand, which had been carried over, so that for the ensuing year the prospect for the building of a larger amount of farm machinery is very promising. This increase, as estimated by good judges, is likely to be from 25 to 40 per cent over the build the year previous. I think it will be fully 35 per cent more than that of last year.

"While some manufacturers are starting in conservatively, yet after they have taken their first of January inventory, they will commence to order materials more freely, and will push their business with the commencement of the new year. From January first to the middle of July, I believe, there will be the greatest activity in the manufacture of all kinds of agricultural and farm machinery, and a largely increased demand and consumption of all kinds of raw and manufactured materials.

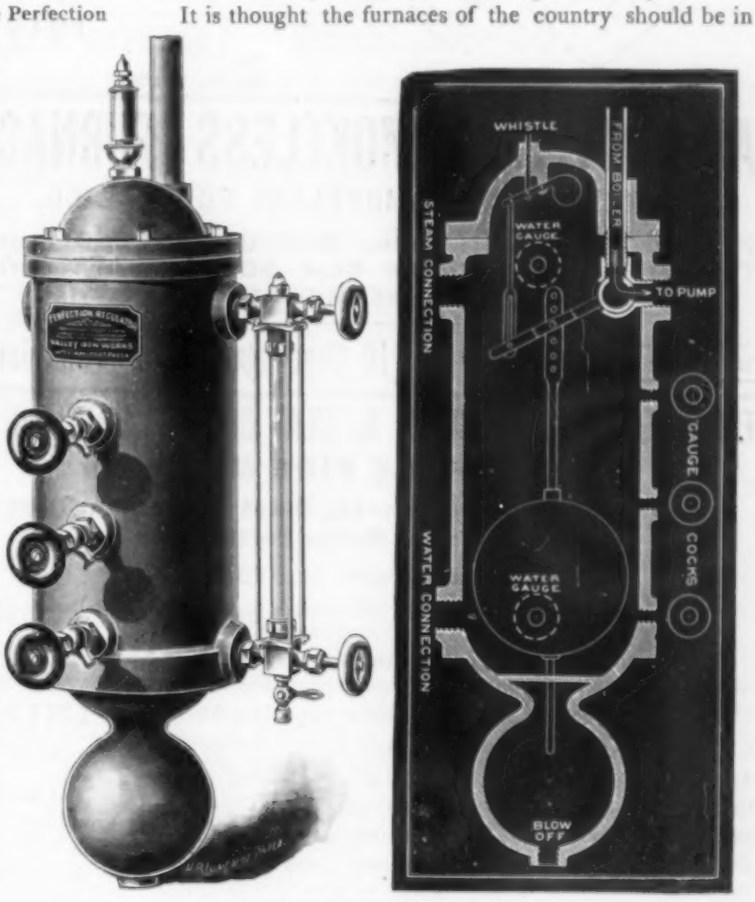
"A. L. CONGER."

FEED WATER PUMP REGULATOR.

The accompanying illustrations give a correct representation with sectional view of a useful steam appliance—the Perfection pump regulator or water governor, designed to control feed water pumps automatically, thereby maintaining a set water level. With the combination of a rotary valve and seamless spun copper float, charged at 150 lbs. air pressure, the admission of steam to the pump is controlled automatically. The slightest decrease of water in the boiler causes the float to drop correspondingly, thereby actuating the valve and opening the port sufficiently to place the pump in operation until the set water level is regained, the fluctuation being less than one-half inch at any time. When the increased amount of water has raised the float sufficiently, it closes the steam inlet and stops the pump. The pump is started and stopped and strokes are increased and reduced automatically the only requirement being that the throttle valve of the pump be kept open at all times. While the makers claim that the machine is perfect, and that there is no possible chance for the water to get low through a failure to act promptly and effectively, there has been placed upon it a whistle that will give quick alarm, if for any reason the pump should give out, or refuse to work, or the water supply be cut off. This device is also automatic in its operation, and will stop blowing only when the set water level has been regained.

The following claims are made by the manufacturers for this device: It will save from eight to twelve per cent in fuel consumption; with the combination of regulator, pump and heater, it will save from 20 to 30 per cent in fuel consumption; it reduces the strain to which all boilers with spasmodic feed are subjected; it contributes greatly to dryness of steam; it minimizes the fluctuation in pressure; it saves largely in the time of engineer or fireman; it prolongs the life of the boiler, and prevents explosion.

In appearance the regulator is similar to a water column, being fitted with water glass and three gauge cocks, making a neat appearance. The manufacturers, the Valley Iron Works, Williamsport, Pa., will give detailed information, or it may be obtained from well known pump manufacturers.



FEED WATER PUMP REGULATOR.

THE pneumatic sand-sifting machine shown in the illustration on page 26 is manufactured by C. H. Haeseler & Co., Philadelphia.

FROM A SOUTHERN STANDPOINT.

The Chattanooga "Tradesman" on the Iron Outlook.

TO THE EDITOR OF THE IRON TRADE REVIEW:

The iron market during 1895 has been somewhat of a puzzle to those engaged in iron making. The beginning of the year ushered in very low prices, and the advance when it came was a genuine surprise, everyone seeming to expect that the market would drag along as it had. But a strong demand sprang up in March and April, and by July had grown to such an extent that it became a boom, and this included all iron products. There were large sales for future delivery. In September the demand fell away and since has been very quiet—for the past month few orders except car-load lots to bridge over for balance of the year. But consumption has kept pace with production and practically there has been no great increase in stocks.

In January, 1895, stocks in the hands of furnaces amounted to 381,000 tons. By December 1, 1895, stocks had fallen to 198,000 tons, showing sales of 183,000 tons of stock in the hands of furnaces to December 1. The slight increase in stocks during November is more attributed to lack of cars than any other cause. November 1, 1895, showed lower stocks at furnaces than at any other time since the year 1888, or for the past seven years.

It is thought the furnaces of the country should be in good position. From some cause consumers have preferred to use up stocks on hand more completely than usual and have stopped buying, which has had the effect to cause a halt in prices.

The pig iron men of the South look for large consumption during 1896. No reason is apparent why that year should not be a good one for the iron trade; but it is difficult to predict how the market will open after the holidays. The future can only be surmised and developments will have to be awaited.

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UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

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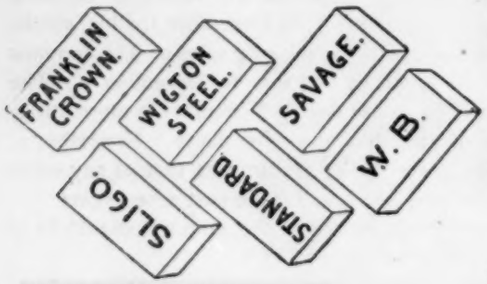
Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Allegany County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Ferguson Block, Pittsburgh, Pa., Stowe, Fuller & Co., 195 Merwin St., Cleveland, Ohio.



Fire Brick, Cupola Blocks, Moulding Sand, Facings, Foundry Tools and Supplies.

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ABSOLUTELY SMOKELESS FURNACES.

THE AMERICAN SMOKELESS FURNACE CO.

The "CLEVELAND" is the Best UNDERFEED Furnace.
The "CUYAHOGA" is the Best DOWN DRAFT Furnace.
Both ARE SMOKELESS.

Write for Particulars. 710 Cuyahoga Building, Cleveland, O.

The Advertiser who sticks to printer's ink in dull months will find trade sticking to him in better times.

THE AMERICAN FIRE BRICK & CLAY CO., Mineral Point, Ohio.

HIGH GRADE FIRE BRICK for

Rolling Mills, Steel Works, Blast Furnaces, Cupola Linings, Boiler Settings.

—All Shapes in Stock—

Our large capacity, 8,000,000 annually, and modern plant, enable us to handle contracts of any size promptly.

Ground or Calcined Clay in Sacks or Bulk.

Stowe, Fuller & Co.

WESTERN AGENTS OF

Mount Savage and Queen's Run Fire Brick,

The leading BRICK of this country.

MANUFACTURERS OF

OHIO FIRE BRICK. ALL SHAPES IN STOCK.

The largest shippers of FIRE BRICK in the West.

Warehouse and Docks: 193-195 Merwin Street,

CLEVELAND, OHIO.

There is little or no apprehension respecting foreign complications. Even if matters grew serious it would be a long while before conclusions would be reached. It is thought the first effect might be depressing; afterwards prices would increase—that was the way in 1861. At first things went to pieces; then prices jumped up higher than before and every iron works became a regular bee-hive. THE TRADESMAN.

Chattanooga, Tenn., Dec. 26, 1895.

DURING the holiday shut-down, the Morton Tin Plate Co., Cambridge, O., added to its plant an acid storage tank of 60 tons capacity, one circle cutting machine and a 61-inch squaring shear. This company is now prepared to produce specialties in sheet steel, pickled and cold rolled, up to 28x40 inches.

ON Jan. 1, the Morton Tin Plate Co., Cambridge, O., established an office at No. 8 South Canal st., Chicago. It will be in charge of W. C. Heimbuecher, formerly of St. Louis. The St. Louis address of this company will be 200 American Central Building, as heretofore.

INDUSTRIAL SUMMARY.

The Berlin Iron Bridge Co., of East Berlin, Conn., has just completed for the H. W. Johns Mfg. Co., at Brooklyn, N. Y., a new dryer house, which is built entirely of steel.

D. B. Gardner, 1224 Stock Exchange Bldg., Chicago, wants to buy an iron lathe and planer.

The H. H. Franklin Mfg. Co., of Syracuse, N. Y., has been incorporated with a capital stock of $100,000, to make and sell metal castings and other goods. The directors are: R. R. Franklin, James P. Geddes, A. P. Seymour, H. K. Chadwick and G. H. Stillwell.

The Keagy & Lear Machine & Foundry Co., Coshocton, O., is a new concern, composed of several local mechanics, who will do a general repair business. The company has ordered its equipment of machine tools and expects to have its plant in operation within the next 30 days.

The Colorado Fuel & Iron Co., Pueblo, Col., has built at its works a merchant iron warehouse 80x160 feet, fitted with all necessary facilities for making rapid and heavy shipments.

The Midvale Iron Foundry's plant at Allentown, Pa., will

U. BAIRD MACHINERY CO.

PITTSBURG, PA.

Have a Special Lot of Second-Hand Tools. All in First-Class Condition.

2—No. 10 Sturtevant Pressure Blowers.
1—No. 5 Root Blower.
1—No. B Long & Allstatter Coping Machine with Engine attached.
1—36″ Gap Leighton and Hathaway Punch.
1—6″Angle Iron Shear, with Rev. Table.
1—1½″ Acme Bolt Header.
1—42″ Rotary Planer.
1—55″ Allen Riveter.
1—32″x25 ft. N. H. Engine Lathe.
1—30x30x8 ft. L. D. & Co. Planer.
1—30x30x8 ft. Harrington Planer

AND MANY OTHERS.

We have all the best makes of New Tools. Send for Second-Hand List.

ROOFING TIN,

"CAMBRIDGE RE-DIPPED"
"CAMBRIDGE NEW METHOD"
"LEATHERWOOD" "NORTH STAR"

FOUR RELIABLE BRANDS.

EVERY SHEET GUARANTEED.
MADE BY EXPERTS OF LONG EXPERIENCE.
ASK FOR PRICES AND SAMPLES.

THE MORTON TIN PLATE CO.
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EUREKA! FLUX ORES! RECLAIMED!

AN INVENTION OF INESTIMABLE VALUE TO THE MINERAL WORLD.

Now ready, machinery and process by which all small or flux ores can be prepared in any shape or size desired, ready for the cupola or furnace, at a very small cost.

Experts pronounce this invention most valuable, furnishing an inexpensive method for utilizing the soft and waste ores and thus reclaiming a large percentage of the most superior minerals.

For terms, machinery, territory, etc., address

Acme Mineral Nugget Co.,

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POTTER & HOLLIS FOUNDRY CO.

STEEL CASTINGS.

Office 525 Rookery, Chicago. Works, East Chicago, Ind.

Light Castings from One to One-Hundred Pounds a Specialty.

POTTER & HOLLIS ENGINEERING CO.,
E. C. Potter, Pres. H. L. Hollis, Vice-Pres.
MINING AND METALLURGICAL
ENGINEERS AND CONSTRUCTORS.
Sole owners in America of the
WALRAND-LEGENISEL STEEL PROCESS.

We are now prepared to place licenses for the use of the WALRAND LEGENISEL process, and to undertake the design and construction of plants with supervision of preliminary operation. The process can be seen in operation at the works of POTTER & HOLLIS FOUNDRY CO., at E. Chicago, Ind. This process is unequaled for the manufacture of solid and flawless steel castings or for any purpose requiring sound masses of steel.

OFFICE, 525 ROOKERY, CHICAGO

be enlarged by the erection of a brick addition to the main building, 80x100 feet.

The Dayton Iron Fence Co. is to remove its plant to Piqua, O., having made contracts for the erection of the necessary buildings at that place. The concern will manufacture iron, steel and wire fence and light ornamental iron work.

The foundry of the Parishville Iron Plant at Ashland, Wis., was burned recently, the loss being $30,000.

The Wendler Machine Co., of Carthage, N. Y., will in a few days resume business under the style of the Adirondack Machine Co.

The plant of the Edinburg Foundry & Machine Co., of Franklin, Pa., has been sold at receiver's sale for $3,635.

Recent installations of the Brightman smokeless furnaces in Cleveland are the following: The Cleveland Faucet Co., Goldsmith, Joseph, Feiss & Co., and the Case School of Applied Science, fourth order.

The deed of the Ætna property and the Iron & Steel furnace of the new company, the Ætna Coal & Iron Co., together with the mortgages of the same to some New York trust companies have been received at the recorder's office. There is one mortgage for $100,000 covering the big Ætna furnaces, and another for $600,000 covering the Ætna property and Iron & Steel combined. The latter mortgage is to the Knickerbocker Trust Co., of New York. The filing of these mortgages is an indication that a loan has been arranged whereby money is to be advanced for the operation of the furnaces. It means that both Ætna and Iron & Steel are to be put in blast, and that repairs and improvements are to begin at no distant day.—[Ironton, O., Register.

The city of Cleveland will spend $12,000 in putting up a new boiler house of steel construction, at its Division street water works pumping station.

The Rex Cycle Co. has been incorporated at Chicago, with a capital stock of $10,000, to manufacture bicycles, by Merritt W. Pinckney, Gustavus J. Tatge and Julius A. Johnson.

The Assyrian Asphalt Co., 409 Rookery, Chicago, wants to buy a No. 5 Gates rock crusher, in good condition.

N. S. Bouton and associates, of Chicago, have secured six acres of land in the southern part of Birmingham, Ala., and will begin at once to build a car wheel works, expecting to have the plant in operation May 1. It will employ 100 men and will have a capacity of 500 wheels a day. Mr. Bouton formerly held large interests in the Chicago & Aurora Smelting & Re-

fining Co., of Chicago. He owns the car wheel plant of the Decatur Mfg. Co., at New Decatur, Ala., and will move that plant to Birmingham.

The car shops of the Pennsylvania road, in Pavona, N. J., were blown down and many cars wrecked, December 26.

The Akron Electric Mfg. Co., Akron, O., has secured the contract for the light equipment of the Diamond Match Co.'s new plant in Liverpool, Eng. There will be two 500 h. p. dynamos, and 1,000 lights will be put in.

Peter A. Anderson, general foreman at the Carrie blast furnaces, Raukin, Pa., while attempting to free the elevating cage, which had become lodged, was crushed between the floor of the car and a temporary platform, on Dec. 25, and died soon after.

Steam Yachts and Marine Machinery,

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

WILLIS SHAW.

Steam Pumps, Boilers, Hoisting Engines, Mine Cars, Trucks, Barrows, Corrugated Roofing, Mill, Mining and Contractors' Supplies.

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Write for prices. CHICAGO, ILL.

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MECHANICAL ENGINEER and DESIGNER of STEAM AND HYDRAULIC MACHINERY.

DESIGNING FOR Steel Works, Rolling Mills and Blast Furnaces A SPECIALTY.

1532 Monadnock. - - CHICAGO.

FANS, BLOWERS, ENGINES,
VENTILATING FANS,
Fan System Heating and Ventilation.

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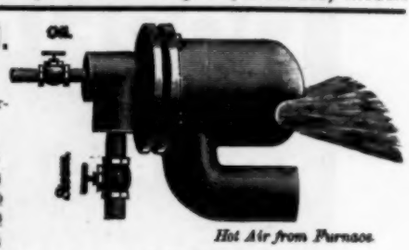
Gen'l Offices, Rooms 77 & 78 When Bldg., INDIANAPOLIS, IND.

Acknowledged the best for Boilers, Forges, Furnaces, Ovens, etc. Write for Catalogues.

BURNER NO. 6.



BURNER NO. 4

BRANCHES. { 1511 Monadnock Block, Chicago. 21 and 23 Fremont st., San Francisco.

NOTE.—If you are using oil as fuel, and are not getting good results, we would be pleased to send you our burners on trial. The oil in our burners can be atomized by either steam or air.

Gummey, McFarland & Co

Manufacturers of the following well-known

American Bright Tin

and TERNE PLATES:

Phœnix, Mars, Neptune,
Climax, Colonial, Anchor,
Venus, Hercules, Pioneer,
Flag, Victor, Stag,
"PENNSYL" Old Method,
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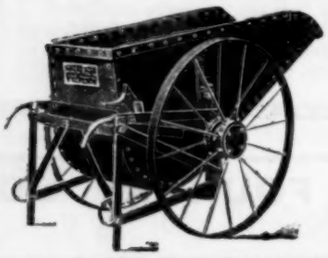

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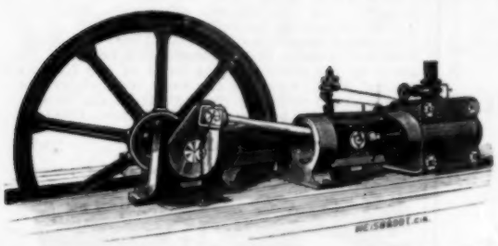

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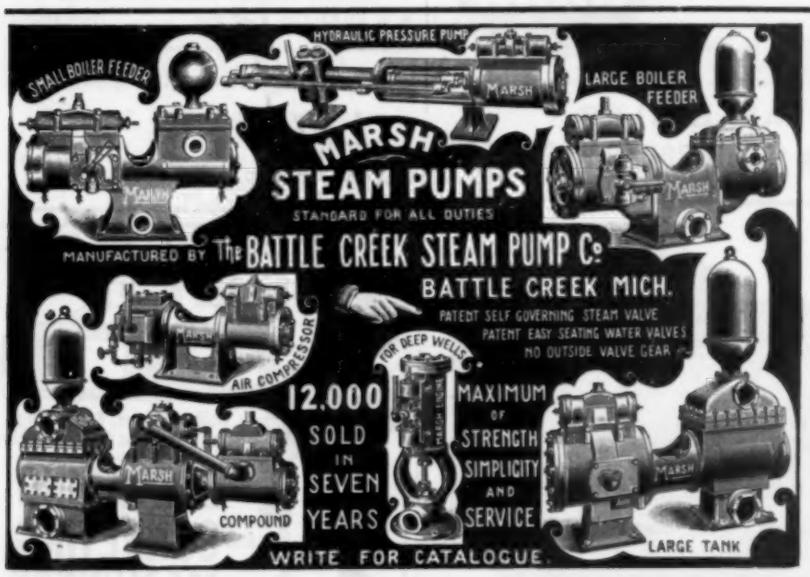

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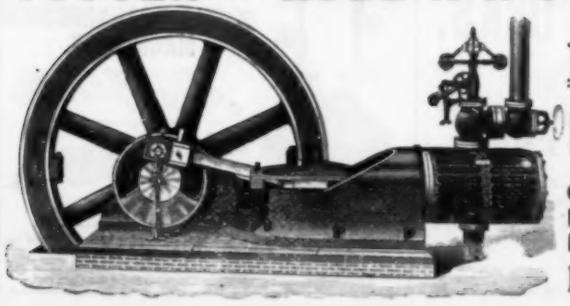

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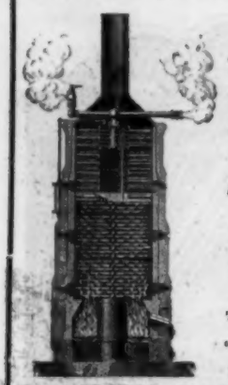

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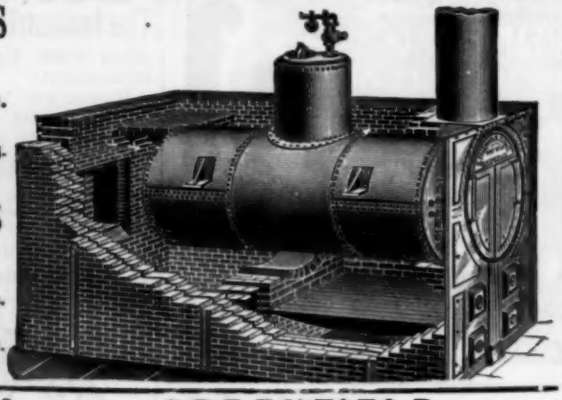

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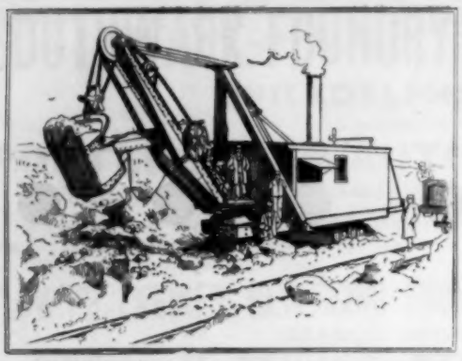

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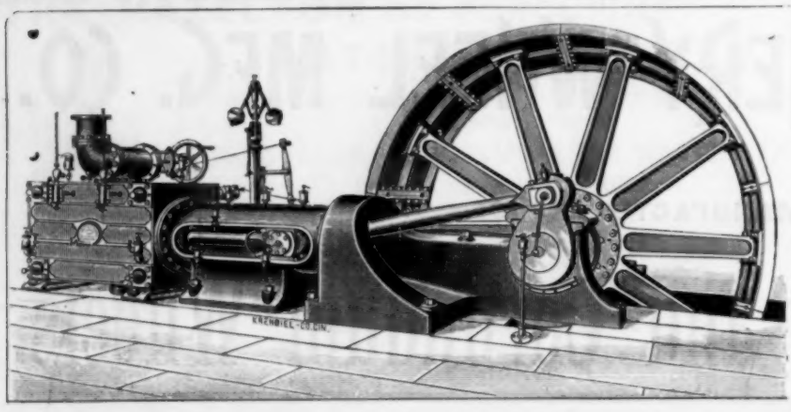

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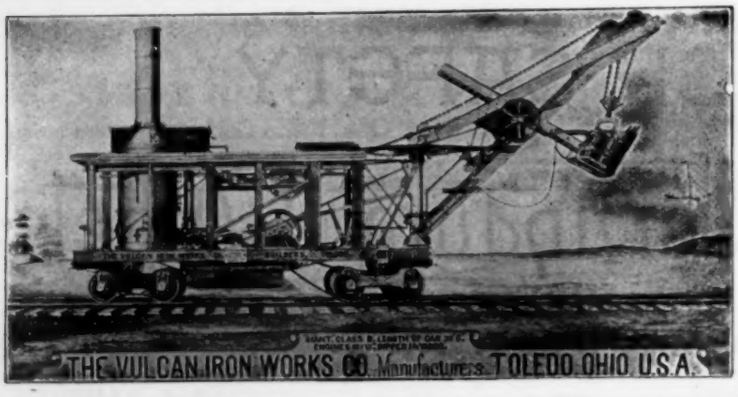

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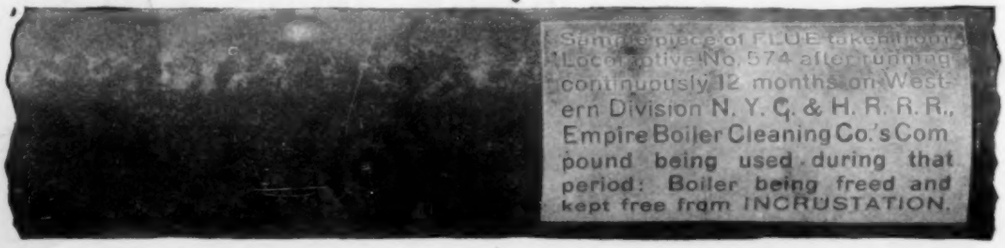
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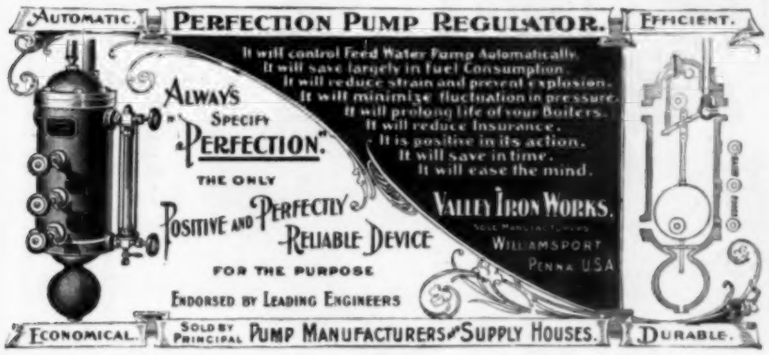
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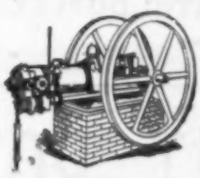

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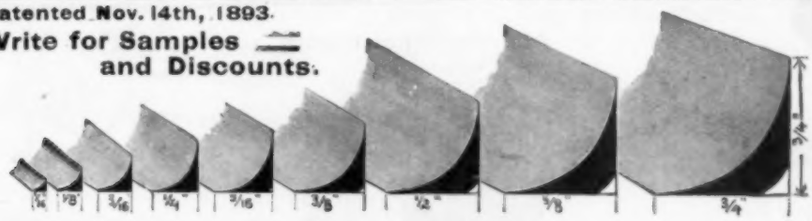

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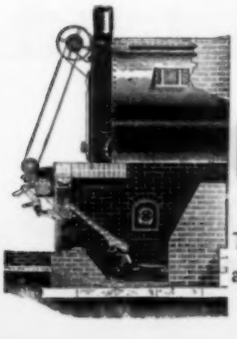

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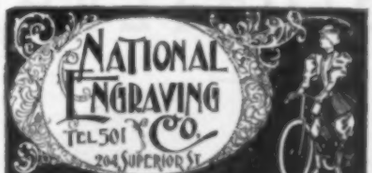

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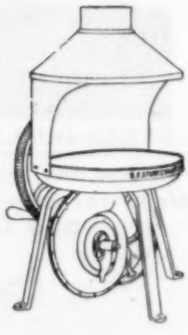

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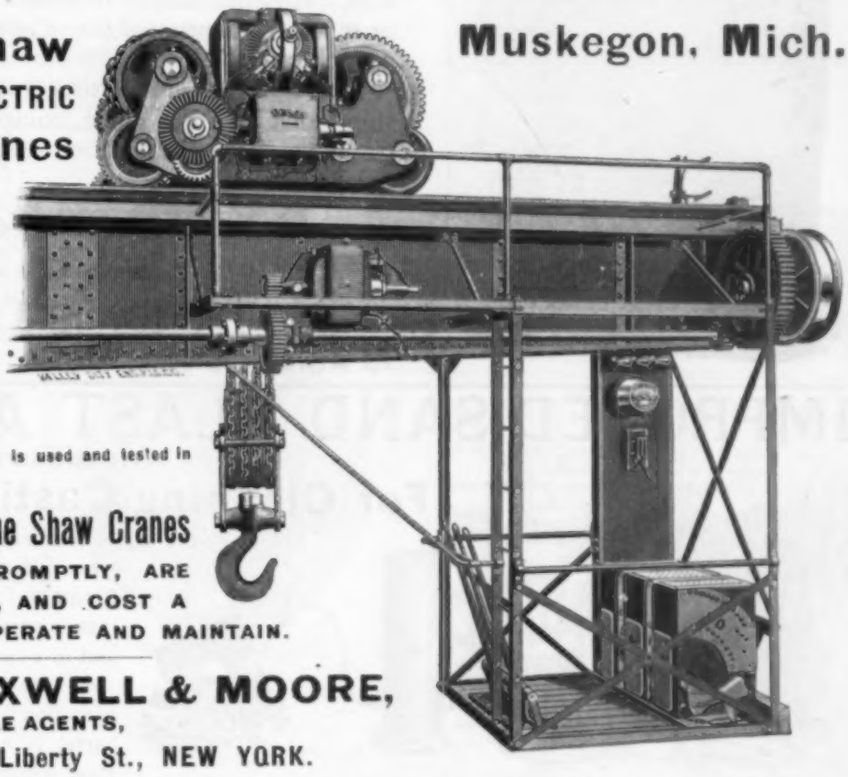

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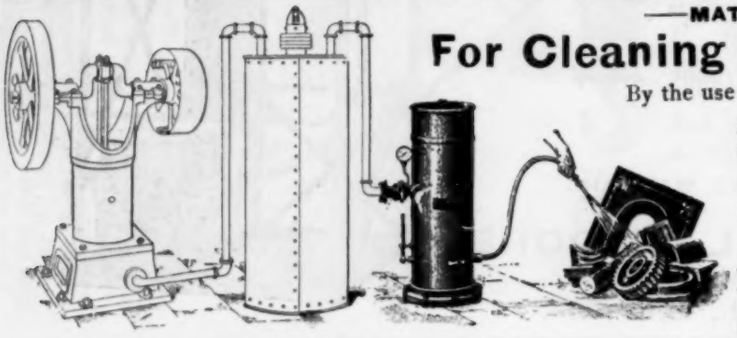

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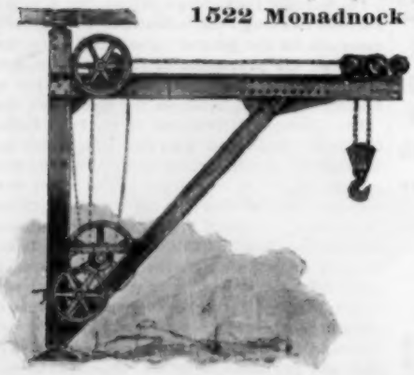

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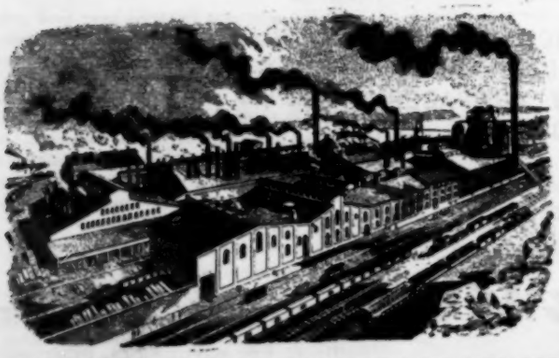

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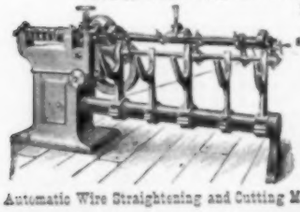

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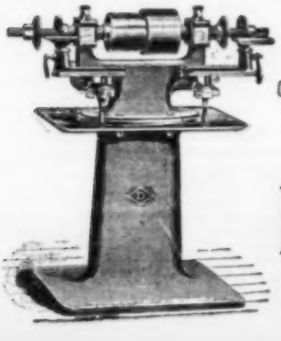

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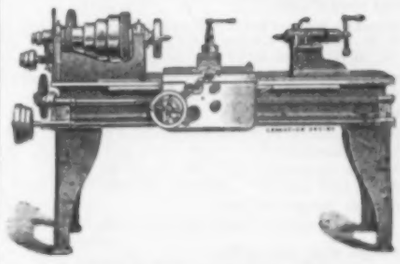

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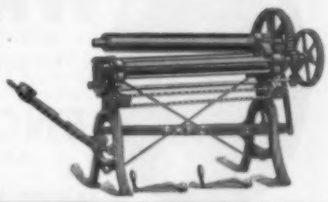

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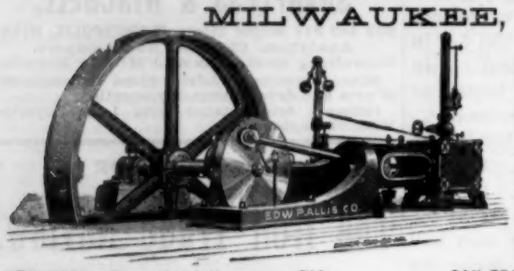

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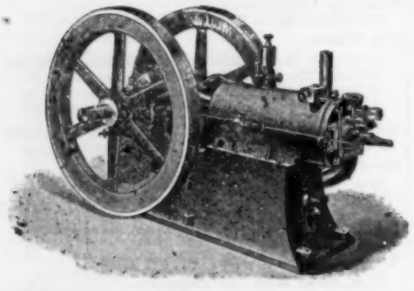

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No. 1 American Scotch	13 50@ 13 75
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Lake Superior Charcoal	14 50@ 15 00

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No. 2 Foundry	13 00@ 13 25
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Local Scotch Foundry No. 2	14 00@ 14 50
Local Scotch Foundry No. 3	13 50@ 14 00
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Southern Coke No. 2	12 85
Southern Coke No. 3	12 60
Southern No. 1 Soft	13 10
Southern No. 2 Soft	12 85
Southern Silveries No. 1	14 00
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" " Mottled	11 75@ 12 25
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2⅜ to 3¼ inch	1 75
3⅜ to 4 inch	2 10
4⅛ to 4½ inch	2 70
4⅝ to 5 inch	2 90

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⅜ to 1¼ inch	1 80
⅜ to ¾ inch	1 80
½	2 00
⅝	2 20

Half Oval and Half Round.

1¼ to 3 inch	2 15
⅜ to 1¼ inch	1 95
⅜ to ¾ inch	2 20
½	2 35
⅝	3 45

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1¼ to 6 by ¼ and 5-16 inch	1 70
1 to 1¾ by ¼ and 5-16 inch	1 75
⅜ to ⅝ by ¼ and 5-16 inch	1 85
½ to ⅝ by ¼ and 5-16 inch	2 10

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1 7-16 to 4, No. 13, 14, 15 and 16	2 15
1 7-16 to 2, No. 17, 18 and 19	2 20
1 7-16 to 2, No. 20	2 30
1 7-16 to 2, No. 21	2 40
1 7-16 to 2, No. 22	2 50
1⅛ to 1⅜, No. 13, 14 and 15	2 20
1⅛ to 1⅜, No. 16, 17 and 18	2 25
1⅛ to 1⅜, No 19 and 20	2 30
1⅛ to 1⅜, No. 21	2 40
1⅛ to 1⅜, No. 22	2 50
15-16 and 1 inch, No. 13, 14 and 15	2 15
15-16 and 1 inch, No. 16, 17 and 18	2 30
15-16 and 1 inch, No. 19 and 20	2 40
15-16 and 1 inch, No. 21	2 50
15-16 and 1 inch, No. 22	2 60
⅞, No. 13, 14 and 15	2 40
⅞, No. 16, 17 and 18	2 50
⅞, No. 19 and 20	2 60
⅞, No. 21	2 70
⅞, No. 22	2 80
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13-16, No. 19 and 20	2 70
13-16, No. 21	2 80
13-16, No. 22	2 90
¾, No. 13, 14 and 15	2 60
¾, No. 16, 17 and 18	2 75
¾, No. 19 and 20	2 85
¾, No. 21	2 95
¾, No. 22	3 05
11-16, No. 13, 14 and 15	2 85
11-16, No. 16, 17 and 18	2 90
11-16, No. 19 and 20	3 00
11-16, No. 21	3 10
11-16, No. 22	3 20
11-16, No. 23	3 30
⅝, No. 13, and 15	2 90
⅝, No. 16, 17 and 18	3 00
⅝, No. 19 and 20	3 10
⅝, No. 21	3 20
⅝, No. 22	3 30
⅝, No. 23	3 40
9-16, No. 13, 14 and 15	3 10
9-16, No. 16, 17 and 18	3 20
9-16, No. and 20	3 30
9-16, No. 21	3 40
9-16, No. 22	3 50
9-16, No. 23	3 60
7-16 and ½ inch, No. 13, 14 and 15	3 30
7-16 and ½ inch, No. 16, 17 and 18	3 40
7-16 and ½ inch, No. 19 and 20	3 50
7-16 and ½ inch, No. 21	3 60
7-16 and ½ inch, No. 22	3 70
7-16 and ½ inch, No. 23	3 80
⅜, No. 13, 14 and 15	3 80
⅜, No. 16, 17 and 18	3 90
⅜, No. 19 and 20	4 00
⅜, No. 21	5 31
⅜, No. 22	4 40
⅜, No. 23	4 55

Light Band.

1⅛ to 6 by 1/16 to 3-16 inch	1 90
1⅛ to 6 by Nos. 11 and 12	1 95
1 to 1⅜ by ⅛ to 3-16 inch	1 95
1 to 1⅜ by Nos. 11 and 12	2 00
⅜ and 13-16 by 1/16 to 3-16 inch	2 10
⅜ and 13-16 by Nos. 11 and 12	2 15
⅜ and 11-16 by 1/16 to 3-16 inch	2 20
⅜ and 11-16 by Nos. 11 and 12	2 25
⅜ and 9-16 by 1/16 to 3-16 inch	2 35
⅜ and 9-16 by Nos. 11 and 12	2 40
½ by 1/16 to 3-16 inch	2 50
½ by Nos. 11 and 12	2 55

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⅜ inch, beveled edge, by Nos. 11 and 12	2 10
⅜ inch, " " " 13 and 14	2 20
½ inch, " " " 11 and 12	2 25
½ inch, " " " 13 and 14	1 55

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No. 10	2 10
No. 12	2 20
No. 14	2 25
No. 15-17	2 35
No. 18	2 50
No. 20	2 65
No. 22-24	2 75
No. 25-26	2 85
No. 27	2 95

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90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
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ROUND, SQUARE AND OCTAGON.	cts. lbs.
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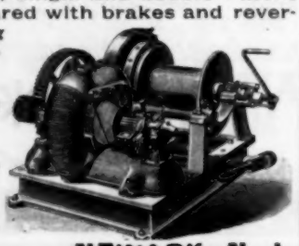

Send for Illustrated Catalogue giving full description, etc.

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W. A. CROOK & BRO'S CO.

Salesrooms 143 Liberty st., N. Y. 117-123 POINIER ST. NEWARK, N. J.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

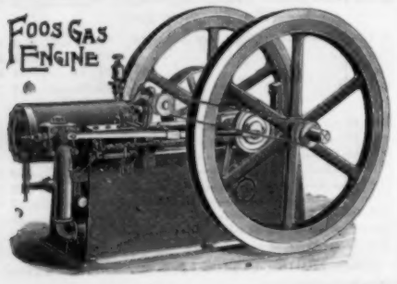
STEEL CASTINGS

OF EVERY DESCRIPTION

Made from Best Open-Hearth Steel.

SEND FOR ESTIMATES.

THE JOHNSON COMPANY, Johnstown, Pa.



THE FOOS GAS AND GASOLINE ENGINES.

FROM 2 TO 100 HORSE POWER.

These Engines give a regular, steady speed, Can be run with Manufactured Gas, Natural Gas, and Gasoline.

MANUFACTURED BY THE

FOOS GAS ENGINE CO.

SPRINGFIELD, OHIO.

CLEVELAND

.. GALVANIZING ..

WORKS.

Galvanizing in all its branches. Highest prices paid for new Scrap Zinc. When in the market for Pump Chains and Rubber Buckets write us for prices.

CLEVELAND, OHIO.

7-16 to ⅜ and 2¾ to 3 in.	.09
3½ to 4 in.	.09½
⅜ to 11-16 and 4½	.10
⅝ to 6 in.	.10½
¾ to 9-32 and 6¼ to 7 in.	.11
7 in	.13

Flats.

	cts. lbs
2 to 9-16 in. wide by 2 to ⅝ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 80
Open-hearth Spring	"	2 20
Sleigh Shoe	"	1 90
Toe Calk	"	2 10
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis. 55
Lap " galv. "	dis. 51½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis 61½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 4[illegible]
Standard, oak tanned	dis 50&1[illegible]
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1¾"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

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PITTSBURG, PA.

Branch Offices:
1123 Betz Building, Philadelphia, Pa.
65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

S. FIX SONS'

STEAM TUBE WELDING WORKS.

Manufacturers of reworked boiler tubes
Good second-hand tubes bought.

CLEVELAND, O.

If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

Holiday Excursions!

Christmas, 1895.
New Year, 1896.

BIG FOUR ROUTE

ONE AND ONE-THIRD FARE

ROUND TRIP

Tickets will be sold between all points on the Big Four Route, good going December 24, 25 and 31, 1895, and January 1, 1896, good returning until January 2, 1896, inclusive.

E. O. McCORMICK, Pass. Traffic Mgr.
D. B. MARTIN, Gen. Pass. & Ticket Agt.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	† 3:25 pm	† 9:50 am
Hudson and Ravenna	* 5:00 pm	* 8:25 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:40 am	* 5:15 pm
Akron and Columbus	* 8:40 am	*5:15 pm
Akron, Columbus & Zanesville	†12:45 pm	†12:10 pm
Akron and Orrville	† 3:25 pm	† 9.50 am
Columbus and Cincinnati	* 8:00 pm	* 6:55 am

The Cleveland Terminal & Valley R. R. Co.

Depot foot of So. Water St.
City Office 137 Superior St.

	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:30 P M	*7:10 A M
Akron, Canton & Valley	*10:10 A M	*3:15 P M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Akron, Canton & Wooster, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:55 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago.

RITER & CONLEY
IRON & STEEL CONSTRUCTION
OF EVERY DESCRIPTION.
STEEL FRAMES,
ROOFS & BUILDINGS,
COLUMNS & GIRDERS.
OIL TANKS & REFINERIES.
BLAST FURNACES,
STEEL WORKS,
BOILERS—ALL KINDS.
STAND PIPES,
GAS HOLDERS,
LARGE DRAUGHT STACKS,
HYDRAULIC FLANGING.
RITER & CONLEY
PITTSBURGH, PA.

"THE IRON TRADE REVIEW"

is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

THE CONDIT-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, . OHIO.

E. C. POPE,

COMMISSION DEALER IN

Iron Ore, Pig Iron

AND METALS.

Cleveland - Ohio.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus St.
Factories on Columbus, Winter and Leonard Sts.,
Cleveland, Ohio, U. S. A.

Oglebay, Norton & Co.,

LAKE SUPERIOR IRON ORES.

— AGENTS —

The Spanish-American Iron Co.,
Santiago, Cuba.

CLEVELAND. PHILADELPHIA.

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 60@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	12c
" " " " over 5 lbs	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15½	11½	8¾	6	5⅛	5¼	
Washers	9	8	7	5	4½	4⅝	4⅛

In lots less than 100 lbs, ₩ lb add ¼c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 85
Standard Penny Nails, ₩ keg card rate	
{ Car lots	$2 30
{ Less than car lots	$2 50

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz	dis 10@10&10

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 50
Medart Pulleys	dis 50
Split Wood Pulleys	dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block	dis 20

Rivets.

Iron, Thousand, list November 1, 1894	dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894	dis 60@65
Copper	dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in	1s 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Apr. 9, 1894

Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	.95c ₩ lb dis 3c

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F F. FF.
Kegs, ₩ lb	4½c	5 c	2¾c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

BRONZE SCREEN PLATES To withstand action of ACIDULATED WATERS.

PERFORATORS OF STEEL, IRON, COPPER, ZINC, BRASS AND TIN.

For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES. DISTILLERIES, FILTER PRESSES. STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

Main Office and Works, 222 to 240 No. Union St., Chicago, Ill., U. S. A. Eastern Office, No. 284 Pearl St., New York.

Commissioner's Sale

—OF—

BLAST FURNACE PROPERTY.

By virtue of a decree of the Court of Common Pleas of Mercer County, Pennsylvania, sitting in equity appointing me a commissioner to make sale of the property of the late co-partnership of Boyce, Rawle and Company, known as the Sharon Furnace, I will offer at public sale on the premises, by public outcry, on January 21st, 1896, at the hour of two o'clock P. M., the following described lands and property situate in Hickory Township, Mercer County, Pennsylvania, between the Boroughs of Sharon and Sharpsville, to-wit:

First:—A tract of land bounded on the North by lands of W. Pierce, B. Myers, M. L. Knight, and others, and on the East by lands of heirs of John Thornton, deceased; on the South by lands of J. L. Miller, Charles Heinz, and Charles Hall, parcel No. 3, a private road and lands of the Sharon railroad, and on the West by the Shenango river, containing about 42 acres. Improvements, one blast furnace now in full blast, one office building, and fourteen dwelling houses. Subject to the rights of way held by the E. & P. R. R. Co., the Sharon Railway, and the Valley Electric Railway Co.

Second:—A parcel of land adjoining the tract above described lying between the E. & P. R. R., and the Sharon and Sharpsville public road, size 50 feet by 80 feet. Improvements, one dwelling house.

Third:—A parcel of land bounded on the North by a part of the lands embraced in the first parcel, and lands of Charles Hall, on the East by lands of Charles Hall and a public road, on the South by lands of Tanner and Carnes, and on the West by lands embraced in the right-of-way of the E. & P. R. R., and a part of the land embraced in the first parcel, containing about seven and a half (7½) acres. Improvements, one dwelling house, occupied by the furnace manager, one tenant house, frame barn, etc. Said lands are shown on a map made by J. M. Goodwin, C. E. Three railroads, the Pennsylvania Company, the Erie, and the Lake Shore now have access to said furnace. Terms, ten per cent at time of sale, the remainder in three installments, one-third when sale is confirmed, one-third in six months, and one-third in one year. Deferred payment secured by bond and mortgage with interest.

NORMAN HALL,

COMMISSIONER.

When you write to firms advertised in our columns, please mention the fact that you took their address from our paper. They will thank you for it.

CHICAGO HEIGHTS

The Industrial Centre of Chicago

offers Free Factory Sites and other inducements.

If you are seeking a new location it will pay you well to investigate the merits of our proposition.

Chicago Heights Land Association

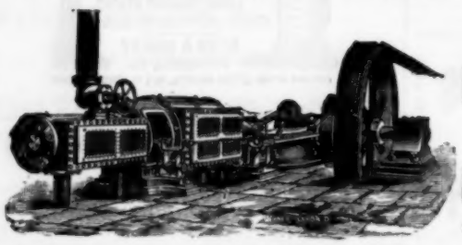
M. H. KILGALLEN, Gen'l Mgr. CHICAGO

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING



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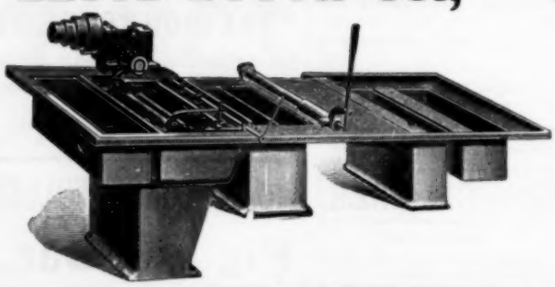
Hydraulic Cranes and Accumulators.

Heavy Special Machinery.

Albert Fisher, Western Agent, 1025 Monadnock Blk., CHICAGO.

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY



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STERLING EMERY WHEEL MFG. CO. TIFFIN, O.

CORRESPONDENCE SOLICITED.

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Somers, Fitler & Clarke, Pittsburg.

McDowell, Stocker & Co., Chicago.

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All to be had in the

Chicago Gas and Gasoline Engines.

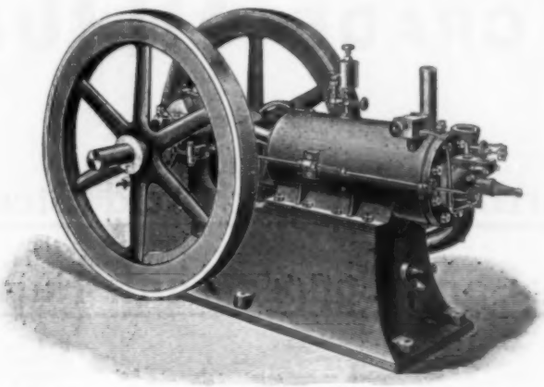
OR NEATNESS,
COMPACTNESS,
AND STEADY RUNNING
HEY HAVE **NO EQUAL.**

A DWARF IN SIZE,
A SAMPSON IN STRENGTH,
EMBODYING THE MOST
DESIRABLE FEATURES.

COST OF RUNNING ALWAYS IN PROPORTION TO AMOUNT OF WORK DONE.

MAKES—

NO ASHES,
NO DUST,
NO SMOKE,
NO ODOR,
NO TROUBLE.



14 H. P. Chicago Engine, showing left side view.

REQUIRES—

NO ENGINEER,
NO FIREMAN,
NO BOILER,
NO COAL,
NO WOOD,
NO STEAM.

CAN BE USED IN MOST ANY PLACE AND FOR ANY PURPOSE THAT POWER MAY BE REQUIRED FOR.

MACHINE SHOPS, FACTORIES, PUMPING WATER,
EMERY WHEELS, VENTILATING FANS,
BLOWERS, MINING.

MANUFACTURED BY

J. J. NORMAN COMPANY

CHICAGO, ILL., U. S. A.

OFFICE
60 South Clinton St.

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GARDEN CITY FOUNDRY CO.,

(INCORPORATED.)

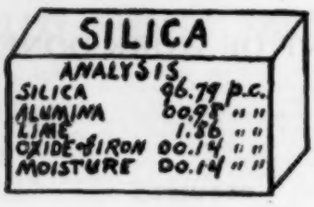
SUCCESSORS TO TURNER, DICKINSON & CO.

Armitage and Central Avenues, Station G, Chicago, Ill.

Friction Clutches,
Hangers,
Pillow Blocks and
Pulleys.

Large Stocks on hand.

Shipments promptly made.



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HIGH.. GRADE **SILICA BRICK**

FOR

Open Hearth, Basic and Acid Steel Furnaces,

Glass and Copper Tank Furnaces.

EXTRA SHAPES MADE TO ORDER.

WRITE US.

THE STUART FIRE BRICK CO.,

Room 21, Conestoga B'ld'g, PITTSBURGH, PA.

The printing of this Anniversary Number of

THE IRON TRADE REVIEW

WAS DONE BY

The Cleveland Printing & Publishing Co.,

27-29-31 Vincent Street, - CLEVELAND, O.

THE BERLIN IRON BRIDGE CO.

CHAS. M. JARVIS, President and Chief Engineer
BURR K. FIELD, Vice-President.
GEO. H SAGE, Secretary.
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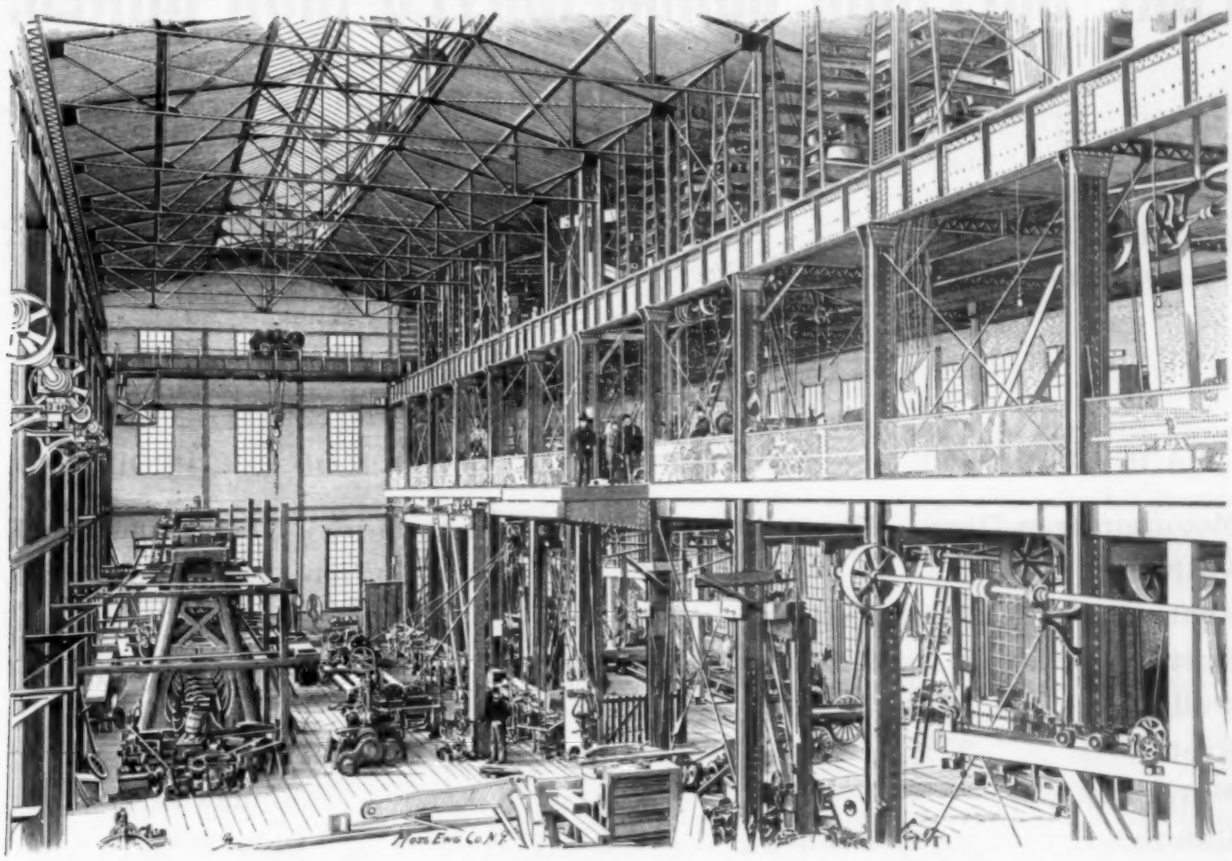
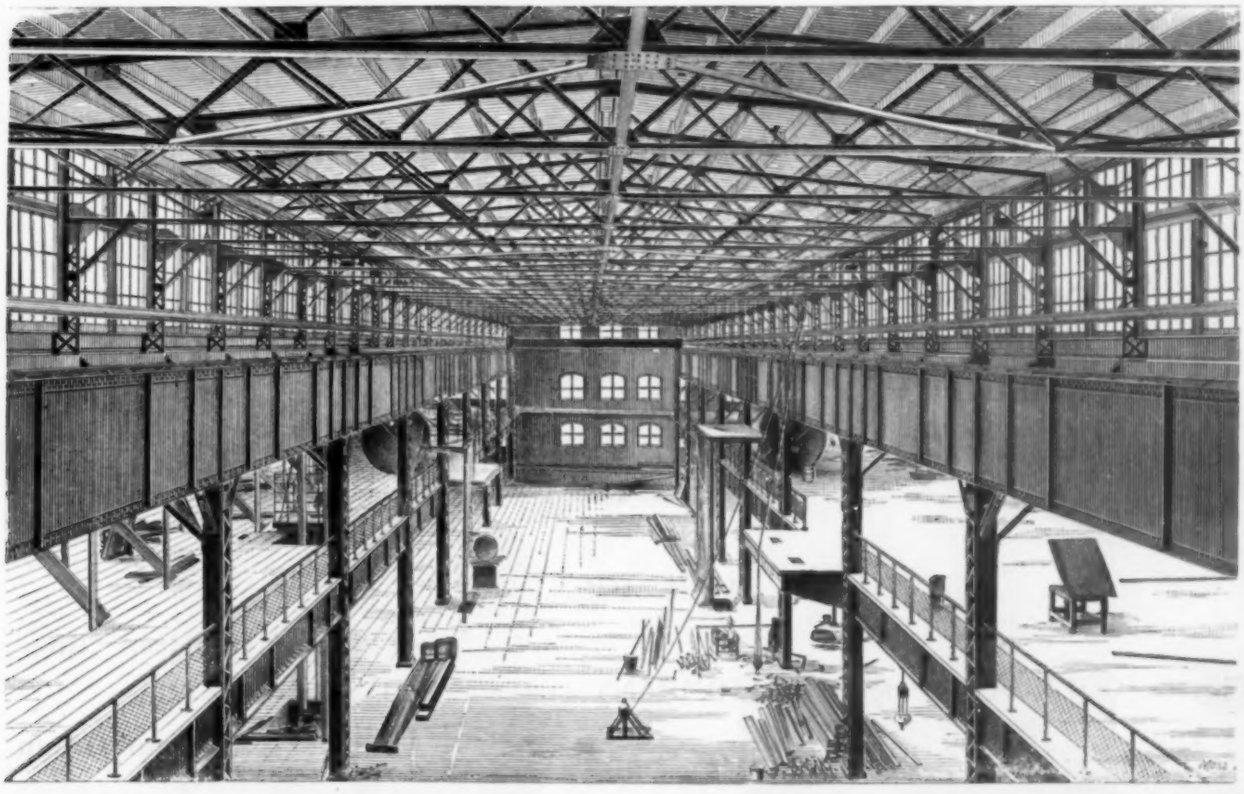


The above illustration is taken direct from photograph, and shows the interior of a Machine Shop designed and built by us for The Dry Dock Engine Co., at Detroit, Mich. The central portion, or Erecting Room, is 40 ft. wide, with a gallery three stories high on one side, this gallery being 27 ft. in width. The upper floor of the gallery is used for storing patterns, while the second floor is used for light machine work, and the lower floor for heavy machine work. This lower floor being controlled by jib cranes, which also swing out into the central portion, thus delivering material from the wings by means of the jib cranes and the traveling crane to any portion of the Erecting Room. The whole frame work of the building is of iron, with brick fillings for the side walls.



The above illustration, taken diect from photograph, shows the construction of a Machine Shop designed and built by us for The Link Belt Machinery Co., Chicago, Ill The building is 124 ft. in width by 407 ft. in length. Each side wing is 42 ft. in width, and two stories high. The central portion of the building is 50 ft. in width, controlled by a traveling crane with a travel the full length of the building. This is probably one of the best designed modern Machine Shops to be found in the United States.

Office and Works, EAST BERLIN, CONN.

ENGINEERS, ARCHITECTS, AND BUILDERS OF IRON AND STEEL STRUCTURES.

LAKE SUPERIOR CONSOLIDATED IRON MINES.

(OPERATING ON MISSABE RANGE.)

MR. FRED. T. GATES, President,
No. 26 Broadway, NEW YORK.

MR. CHAS. E. SCHEIDE, Sec'y & Treas.,
No. 1 Broadway, NEW YORK.

NAME OF MINE.		LOCATION.		GRADES OF ORE PRODUCED.
Mountain Iron Mine,		Mountain Iron,	Minn.	Mountain Iron, Helmer and Tubal.
Rathbun	"	"	"	Mountain Iron, Helmer and Tubal.
Adams	"	Eveleth,	"	Adams.
Burt	"	Hibbing,	"	Linwood.
Hull	"	"	"	Linwood.
Rust	"	"	"	Linwood.
Minnewas	"	Virginia,	"	Minnewas.
Duluth	"	Biwabik,	"	Duluth.

SHIPMENTS TO DATE.

Mountain Iron Mine,	987,787	tons.
Rathbun "	82,050	"
Adams "	59,141	"
Burt "	58,123	"
Minnewas "	16,020	"
Duluth "	37,852	"

SALES AGENTS:

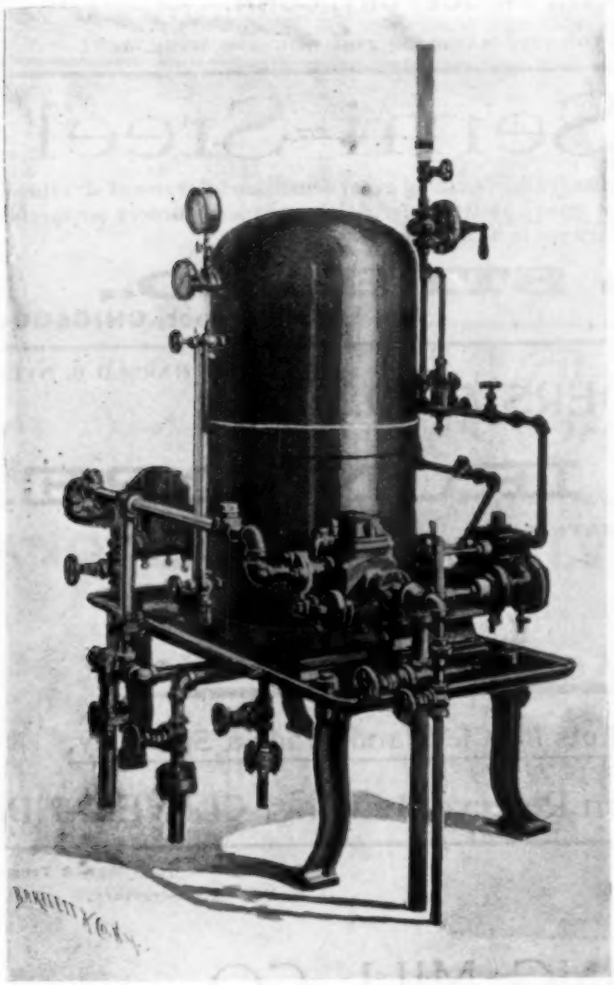
Messrs. OGLEBAY, NORTON & COMPANY, CLEVELAND, O. — Mountain Iron Mine. Rathbun Mine. Lake Superior Group.

Messrs. TOD, STAMBAUGH & COMPANY, CLEVELAND, O. — Adams Mine.

MR. W. C. RUNYON, Cleveland, O., - - - - Minnewas Mine.

ARE YOU INTERESTED IN OIL FOR FUEL?

IF SO, THE FOLLOWING FACTS WILL INTEREST YOU:



The Rockwell Improved Duplex System for burning fuel oil is a scientific and simple machine, which handles any kind of fuel oil, pumping it from the storage tank into a pressure tank where it is purified, heated and delivered to the fires in the best possible condition for combustion. The following are some of the advantages of the system:

It is perfectly automatic.

Gives uniform and steady pressure up to 50 lbs., or more if desired.

Does not depend at all on **gravity,** being operated by constant pressure.

Heats the oil to a high degree under pressure without evaporation, frees it from water and sediment, and delivers it to the fires **Steady, Hot** and **Clean.**

Made in sizes to suit any number of fires.

Wherever oil is used as fuel, this system will pay for itself promptly. There are many now in use by the best manufacturers. It is used in **Steel Works, Copper and Brass Rolling Mills, Malleable Iron Works, Bicycle Works, Glass Works, Bolt and Nut Works, Forging, Brazing, Enameling, Japanning, Tempering, Hardening, Refining, Drying Malt, Sand, Ore, Phosphate, Singeing Cloth, Burning Garbage, Lime, Cement, etc.**

The system can be applied to furnaces now using oil under gravity or other imperfect methods, or to those using coal, coke or gas.

We also design and build furnaces of all kinds to be operated by oil, coal or gas as fuel.

Full particulars upon application.

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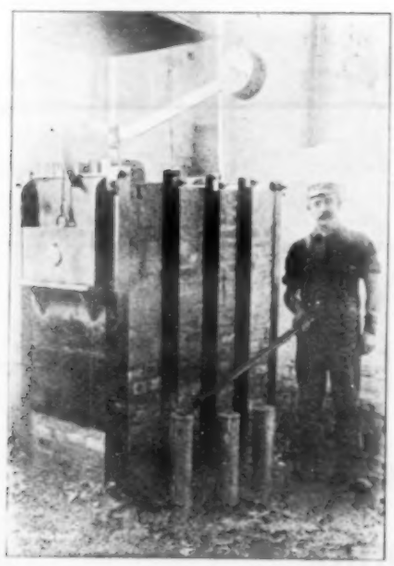
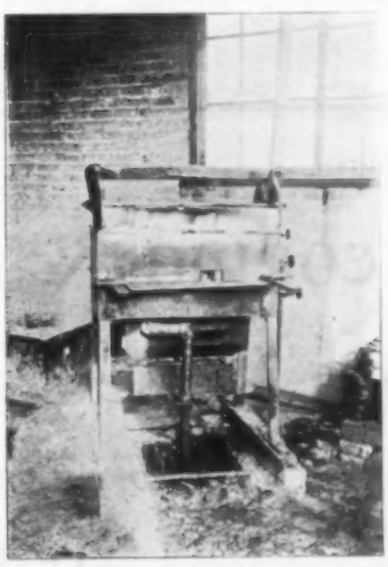


CASE HARDENING OR TEMPERING FURNACE.



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TAPER ROLLING MACHINE,

For rolling flat points on bars, as used for Files, Round and Flat Car Springs, Agricultural Work, &c.

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Is a Branch of THE UPSON NUT CO., of Unionville, Conn., which business was established in 1854.

In 1872 the Company, associated with other parties, commenced the manufacture of Nuts and Washers in Cleveland, under the name of The Cleveland Nut Co. In 1874 they purchased their associates' interests and changed to its present title. In 1889 the business of The Hotchkiss & Upson Co., manufacturers of Bolts, was purchased and consolidated with that of The Upson Nut Co.

THE RANGE OF GOODS MANUFACTURED INCLUDES

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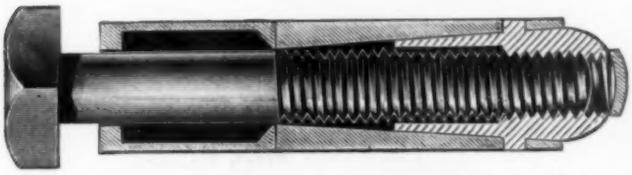
The main factory buildings are about 800 ft. long by 50 to 150 ft. wide, and are fully equipped with every kind of labor-saving machinery known to the trade, and the output is as great as that of any other factory of its kind in the country.

The large trade it has established has been secured by the uniformly high quality of the work turned out. Their trade extends to every State in the Union, and to several foreign countries.

EXPANSION BOLTS.



For fastening all kinds of structure to Brick and Stone work.

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The Patentee and Manufacturer,

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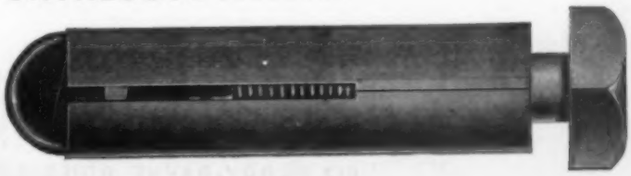

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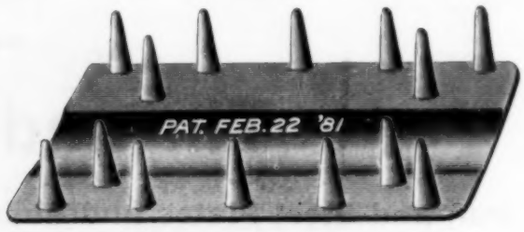
Can be used on all kinds and makes of belting, and is the best and cheapest thing to use for fastening belts.



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THE LARGEST PATTERN WORKS IN THE WORLD.

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MIKADO, " "
WINDSOR, " "
FRANKLIN, Mesabi Hematite.
OLIVER, " "
SOUTH SIDE, " "
CHAPIN, Blue "

NON-BESSEMER ORES.

WINTHROP, Red Hematite.
REX, Blue "
PREBLE, Mesabi "
MARQUETTE, Red " (High Silica.)
DUNN, Red "
FLORENCE, Red "

FIX ORE.

CHAPIN.

PIG IRON.

BUFFALO, Strong Foundry (all ore.)
MABEL, " " " "
MABEL, Bessemer.
CLAIRE, "
ROSENA, "
COKE MALLEABLE.
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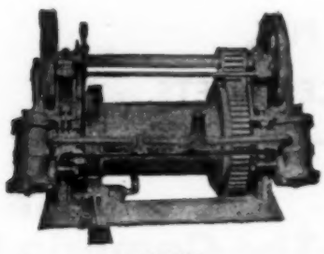
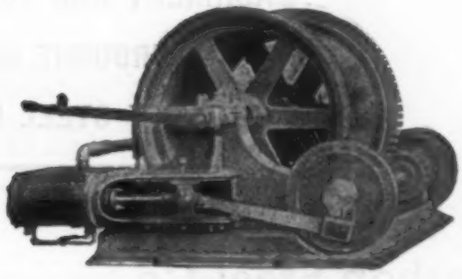
Hoisting, Crushing, ...AND... Mining Machinery.



BACON'S
Underground Hoisting Engine.



BACON'S
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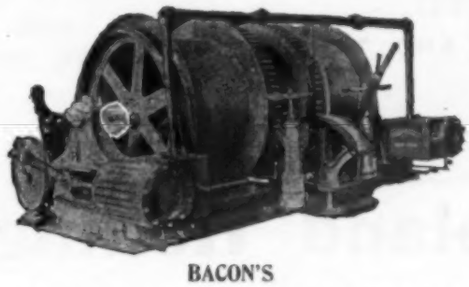
HOISTING, CRUSHING and MINING MACHINERY.



WORKS:
Pacific Iron Works,
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BACON'S
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EARLE C. BACON,

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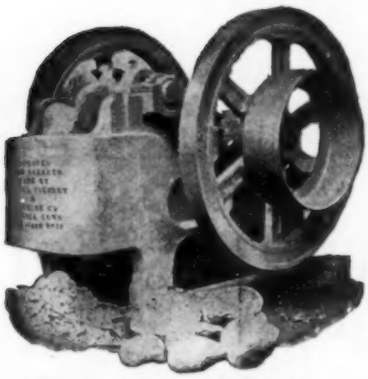
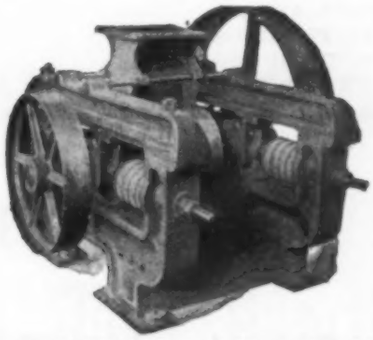


Farrel's Ore and Rock
CRUSHERS.



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Complete Hoisting and Crushing Plants our Specialty, and Mine Equipments.

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SPRING STEEL,
BAR STEEL,
STEEL WIRE,
BARBED WIRE,
IRON AND STEEL BOILER PLATE,
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DEALERS IN ALL VARIETIES OF

Lake Superior Iron Ores and Charcoal Pig Iron

FROM THEIR OWN MINES AND FURNACES.

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Successors to

MOOREHEAD-McCLEANE CO.

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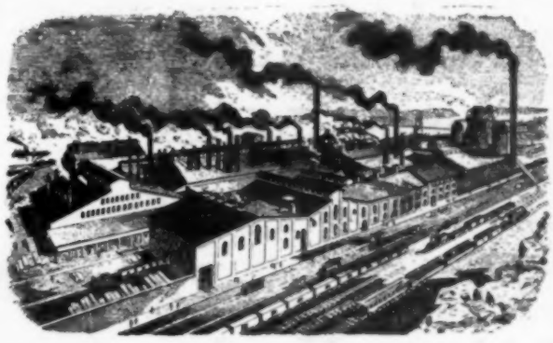

Having purchased, repaired, and put in operation these well known works, we are

PREPARED TO FILL ORDERS PROMPTLY.

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Bessemer Pig Iron and Open Hearth Steel,

And

We ROLL AND SHEAR PLATES TO DIMENSIONS.

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The Morrin "Climax" and "Compound" Water Tube Boilers.

No Screw Joints.
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No Ground Joints.
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No Cast Iron Pipes, Manifolds or Headers to cause trouble from Unequal Expansion or Contraction.

QUICK AND STEADY STEAMERS, POSITIVE CIRCULATION.

The "Climax" is Built in Units of 50 to 1000 H. P.
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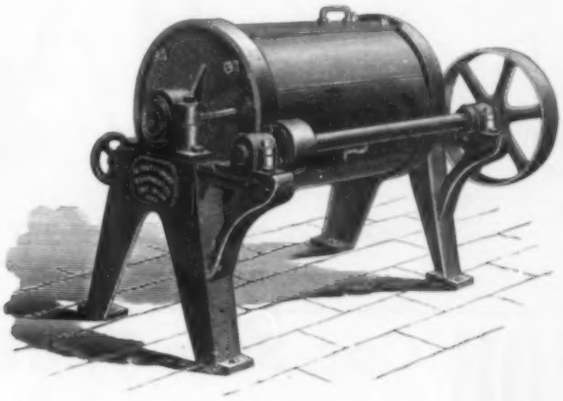
Specifications, Blueprints, Etc., Etc., Furnished on Application.

SEND FOR "CLIMAX" AND "COMPOUND" CATALOGUES.

1522 MONADNOCK BLOCK, CHICAGO. Works, HARVEY (Chicago Suburb).

Body Section of Whiting Cupola.



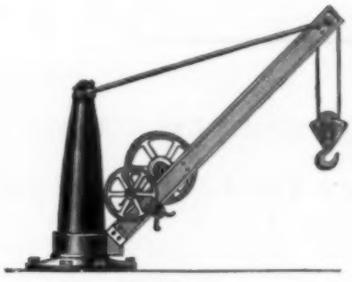
Friction Tumbler, No. 2.

A Few Illustrations

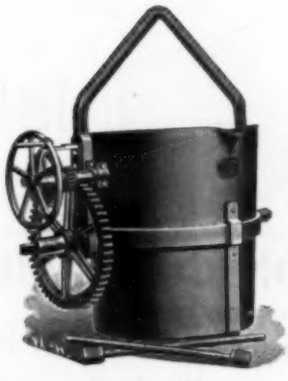
It is impossible to show all we make on one page. We submit only a few reminders: The best Cupola made; an improved Air Hoist; a good Geared Ladle; a useful and convenient Tumbler, etc. We also make all kinds of Cranes—any power, any capacity, Jib or Traveling. Elevators, Sand Sifters, etc., etc. Our new Catalogues will tell you all about it; send for some—they cost you nothing.

We would be pleased to quote prices. We make and sell **direct from the factory.**

Air Hoist.

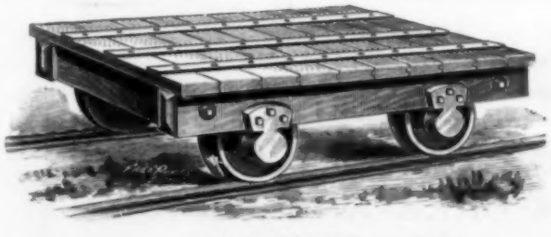


Pillar Crane.



Crane Ladle.

COMPLETE FOUNDRY PLANTS.



Standard Truck.

WHITING FOUNDRY EQUIPMENT CO.

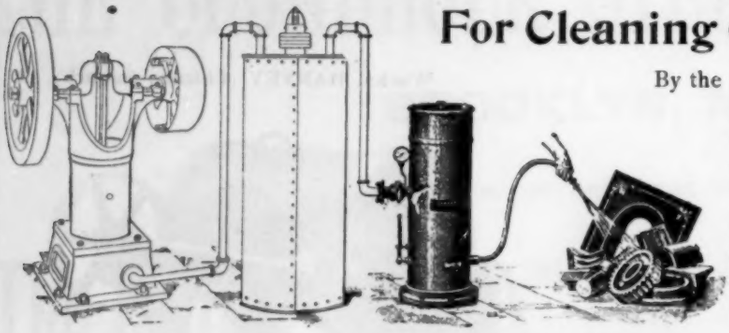
1522 Monadnock Block, CHICAGO.
Works: HARVEY, ILL.

It pays to buy direct from the Manufacturer.

IMPROVED SAND BLAST APPARATUS,

MATHEWSON'S PATENT

For Cleaning Castings, Forgings, Etc.



By the use of common, sharp, dry sand, and with a compressed air pressure of 15 lbs., this Apparatus will **Clean** all forms of castings **more thoroughly** than is possible by hand, for **half the total cost,** and in a space of time that cannot be conceived until the machinery has been seen in actual operation. For small castings a special tumbling barrel is worked in connection with the sand Blast Apparatus. For further particulars, apply to

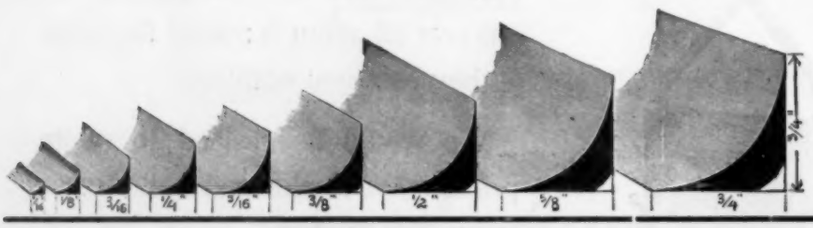
WARD & NASH, Agents,

23-25 Purchase Street, BOSTON. 35-37 South Canal Street, CHICAGO.

YOU Can Save TIME, as we have the TIME SAVER.

THE BELDING LEATHER FILLET.

Every Pattern Maker knows that labor is almost the total cost of any pattern. You can **Reduce the Cost** by using the **Belding Fillet.** Our customers have learned this fact. A sample order will convince **you** also.



The Canton Leather Fillet Co.

CANTON, OHIO.

STEWART IRON CO., Limited,

MANUFACTURERS OF

Special Low Phosphorus Standard Bessemer and Foundry Pig Iron.
Also Special Low Phosphorus Muck Bar and Billets.
Manufacturers of Coke.

Mills and Furnaces at SHARON, PA. Coke Works at UNIONTOWN, PA.
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LAKE SUPERIOR IRON ORES AND PIG IRON.

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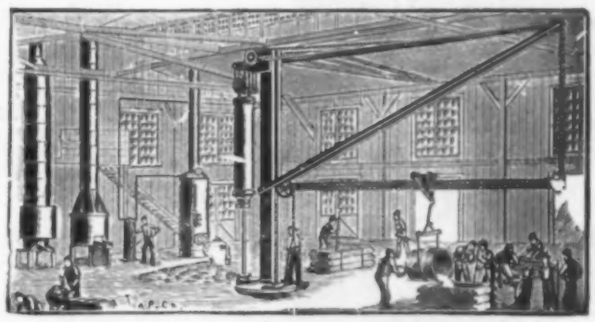
Perry-Payne Building, - - CLEVELAND, O.

Well, What Did Old Kris Bring You?

Lots of nice things, we hope, with just dead loads of Love behind them all.
It isn't the presents that makes the Christmas, but the hearts.

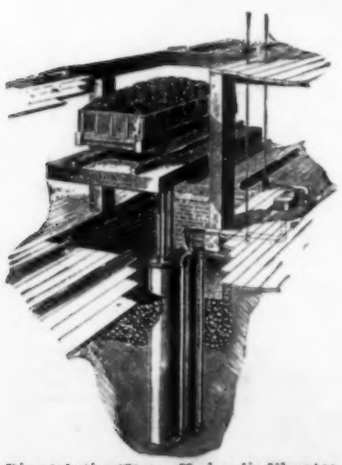
Of course you are not in the humor to-day to talk or even think Cranes, and neither are we—it's too soon after Christmas. But the end of the year is now within reaching distance and the new year will soon demand attention. What are you going to do next year? Are you still going along doing your work by main strength and awkwardness, wasting a big lot of money which you might have for next Christmas, or are you going to get into correspondence with RIDGWAY and find out whether or not he and that wonderful Crane of his he blows so much about, can really make the saving that he says it is doing for concerns all over the land?



5-ton Steam-Hydraulic Crane in a Foundry.

If we were you, that's one of the good resolutions we would make on New Years, along with usual batch of them. When a good responsible concern spreads out a list of users as long as your arm, which you at once recognize as the leading concerns in the land to back up what he says, that concern surely deserves more than ordinary consideration at the hands of wide-awake heads of establishments, don't it?

"PLEASE TAKE THE ELEVATOR."

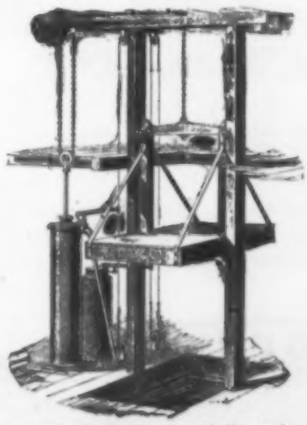


Direct Acting Steam-Hydraulic Elevator

From Christmas privilege down to all the cares of every-day life, it brings you as gently as it took you up.

Craig Ridgway & Son,

COATESVILLE, PA.



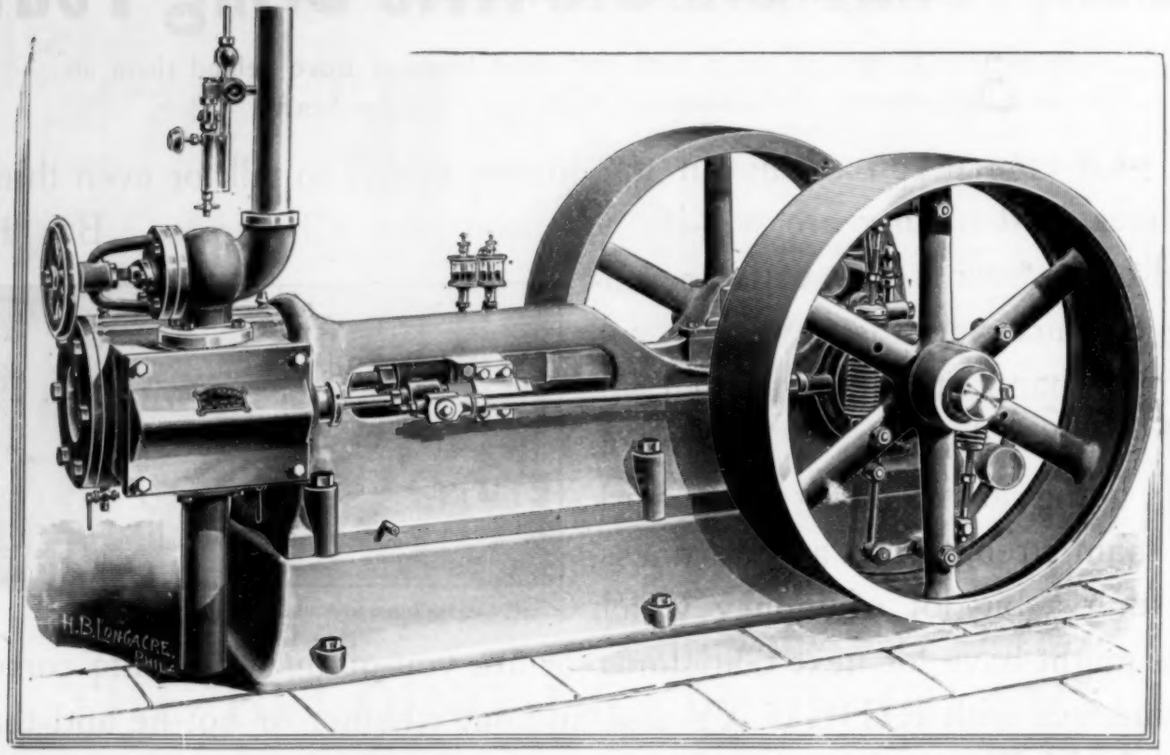
Steam Hydraulic Elevator, also made direct acting with cylinder under platform.

THE CHEAPEST "HIGH CLASS" ENGINE ON EARTH.

ESPECIALLY DESIGNED FOR
Economical Steam Consumption and Close Regulation.

THE "VALLEY" AUTOMATIC.

THE "VALLEY."



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Our first car of **Tin** and **Terne Plate** went to a St. Louis house. That same house has been drawing their supplies from us ever since.

We don't say our plate is the best in the world, but we do say it's **good,** and gives satisfaction.

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In the Gas Country, **ATLANTA, IND.**

P. S.—Redipped **Ternes** and **Charcoal** after January 1st, 1896.

To Those Interested in Smoke Consumers.

The following test upon the efficiency of

THE OEHLSTROM STOKER AND SMOKE PREVENTING FURNACE

at American Wire Co.'s Plant, Cleveland, O., will be of interest:

THE OEHLSTROM STOKER CO., Cleveland, Ohio. NOVEMBER 15, 1895.

Gentlemen:—In the examination of the efficiency of the Oehlstrom stoker, in which I assisted Nov. 4, 1895, I obtained the following results:

The test of working efficiency was made on two boilers, each provided with an Oehlstrom stoker, and connected into the same chimney, 75 feet high, and 48 inches in diameter. The dimensions of the boilers, the grate, the proportions of grate surface to boiler surface, the steam pressure, the volume of water supplied to the boilers, the temperature of the feed water, and the weight of coal used during the test, are all given in the accompanying report of the superintending engineer, Mr. D. Evans, of the American Wire Co. The duration of the test was *eight hours, from 1 P. M. to 9 P. M.* The fire was in a fresh condition at the beginning, and at the close the ash and cinders were removed so far as possible from the grate and when cold, weighed. A fine Bituminous slack coal was used.

Analysis of the coal:

Carbon,	69.52 per cent.	Nitrogen,	1.42 per cent.
Hydrogen,	5.75 "	Moisture,	2.68 "
Ash,	11.46 "	Oxygen,	5.88 "
Sulphur,	3.29 "		100 00 "

The heat of combustion of this coal calculated from the analysis for each pound of the coal, is *13,194 heat units.*

Composition of the flue gases:

Carbonic Acid,	7.00 per cent.	Carbonic Oxide,	None.
Oxygen,	16.00 "	Marsh Gas,	None.
Nitrogen,	77.00 "	Sulphurus Acid,	Not determined.

These results show that the *combustion is complete.* *No soot* escaped from the chimney. (See cut.) Altogether the combustion *was as nearly perfect* during the entire test as it is possible to obtain under such conditions.

Calculation of the combustible consumed, and the ratio of combustible to water evaporated, from the composition of the coal and the smoke gases:

Deducting ash, hygroscopic water, and unconsumed carbon from the coal weighed, the weight of *pure combustible* is *7,936 lbs.*

The weight of *pure carbon* calculated from the composition of the smoke gases is *6,426* lbs., calculated from the composition of the coal burned it is *6,549* lbs. This difference probably represents loss in dust, and excess of air introduced over the grates in other ways than that indicated by the airmeter under the grate. The *weight of air* supplied at the grates for every pound of combustible was *27.26* pounds. This volume of air is somewhat in excess of the amount consumed in ordinary firing, *24 pounds.*

The total weight of water evaporated as shown by the Worthington meter, temperature 192°.46, was 69158.964 lbs. This corresponds to 9.22 lbs. of water evaporated *per lb.* of pure combustible at 212°.

Heat lost in the chimney gases:

The number of heat units per pound of coal calculated from the results of analysis was 13,194. Since the total number of pounds of pure combustible was 7,936, the total quantity of heat produced during the test was *104,733,972* heat units. The quantity of heat required to evaporate 69,159 lbs. of water, introduced into the boilers at 192°.46 F., under a gauge pressure of 96 lbs., corresponding to 334° F., is *70,740,000.* This corresponds to a loss of heat equivalent to *32.4* per cent. of the total quantity produced. Of this amount between *5* and *12* per cent. is unavoidably lost in radiation and conduction, leaving the *loss in chimney gases between 17.4* and *27.4* per cent. (See below.)

The quantity of heat lost in the chimney gases, calculated from the atmospheric humidity, which was 40, the *moisture in the coal,* the *water* produced from the *combustion* of the *hydrogen* in the *coal,* the *excess* of *air,* and the *products* of *combustion,* amounted at the chimney temperature, 550° F., to *26,169,000* heat units, or a loss of 25 per cent. of the total heat produced in the combustion.

Summary of results:

Coal burned, deducting ash moisture and loss, 7,936 lbs. Water evaporated at temperature of feed, 69,159 lbs.

Lbs. of water evaporated at 212° F. per lb. of Bituminous slack coal, 9.22. Heat consumed in evaporating 69,159 lbs. Feed water under 96 lbs. Steam pressure, per lb. of combustible, 8,914 heat units. Heat lost in radiation, conduction and in chimney gases per lb. combustible, 4280 heat units. Heat lost in chimney gases per lb. of combustible, 3,298 heat units.

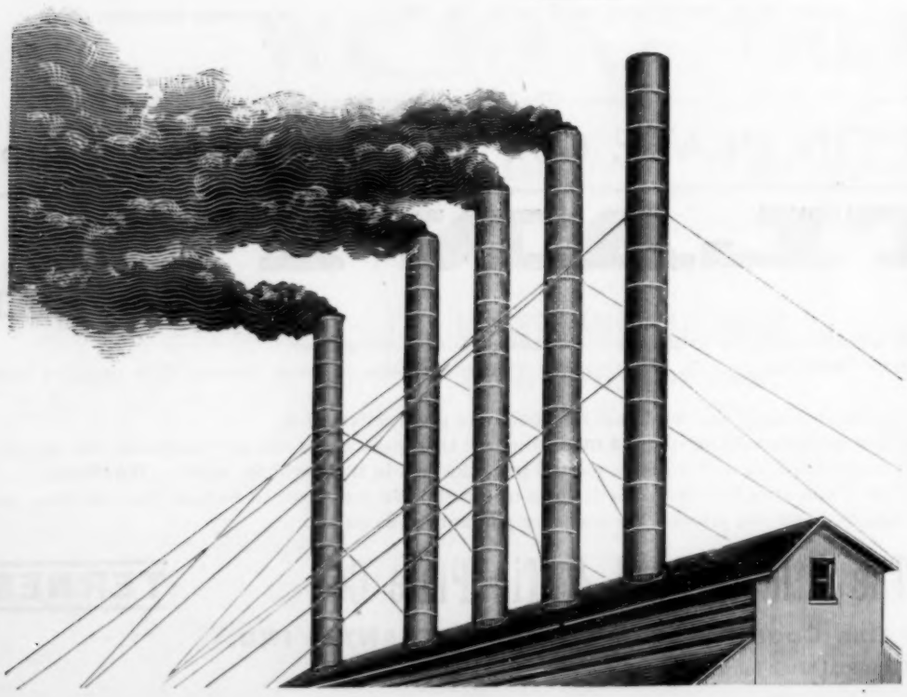
General conclusion.

The quantity of water, 9.22 lbs. evaporated per lb. of pure combustible is larger than is obtained in ordinary firing. *The combustion is complete; the chimney gases contained no carbonic oxide; the escaping chimney gases contained no soot.* The loss of heat in the chimney gases is probably less for the same efficiency than in the ordinary method of firing.

Yours very truly, **Charles F. Mabery,** Professor of Chemistry, Case School of Applied Science.

I have reviewed the calculations of Professor Mabery in this report, and have found them correct.

C. H. Benjamin, Professor of Mechanical Engineering, Case School of Applied Science.



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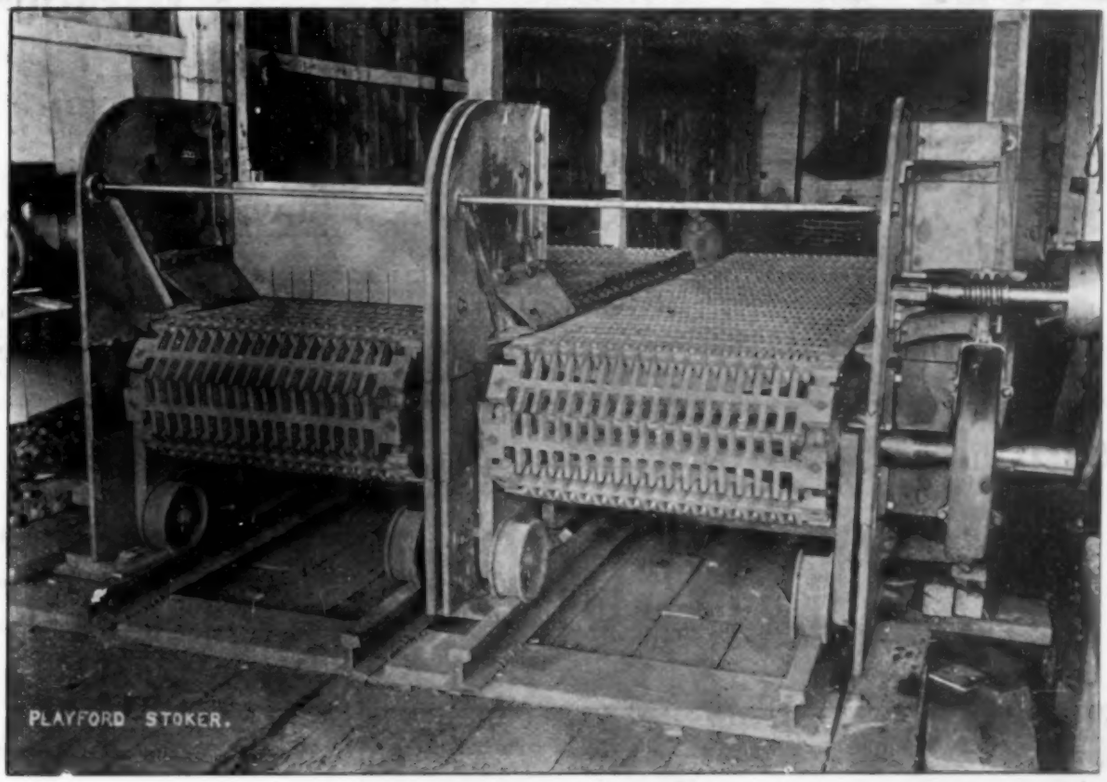

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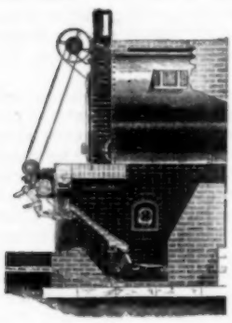

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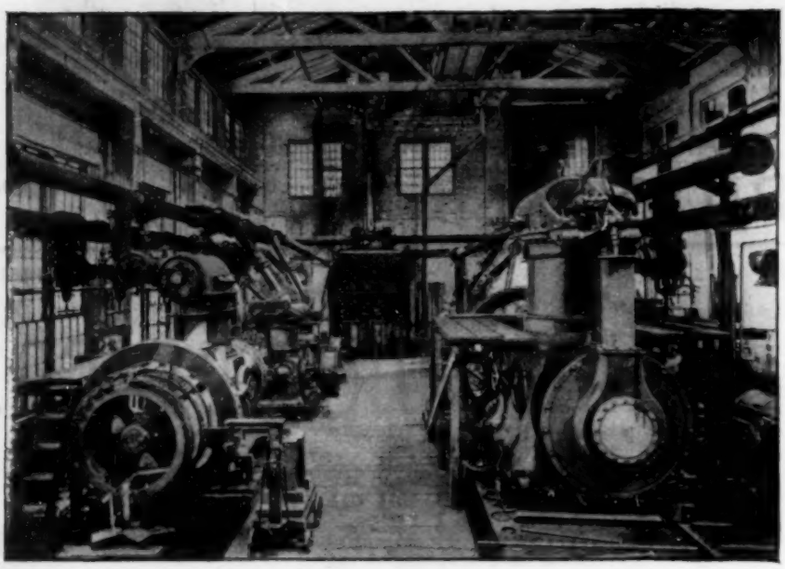

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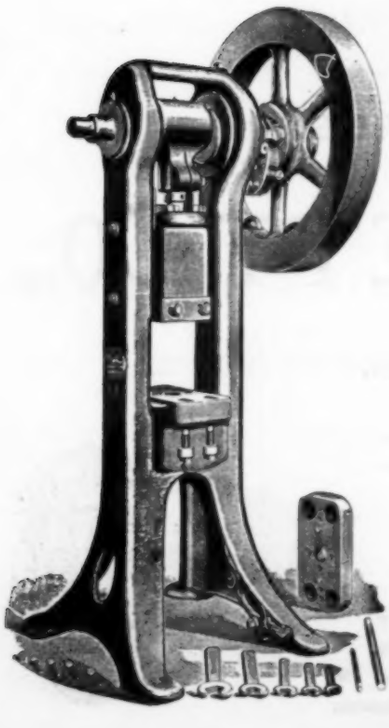

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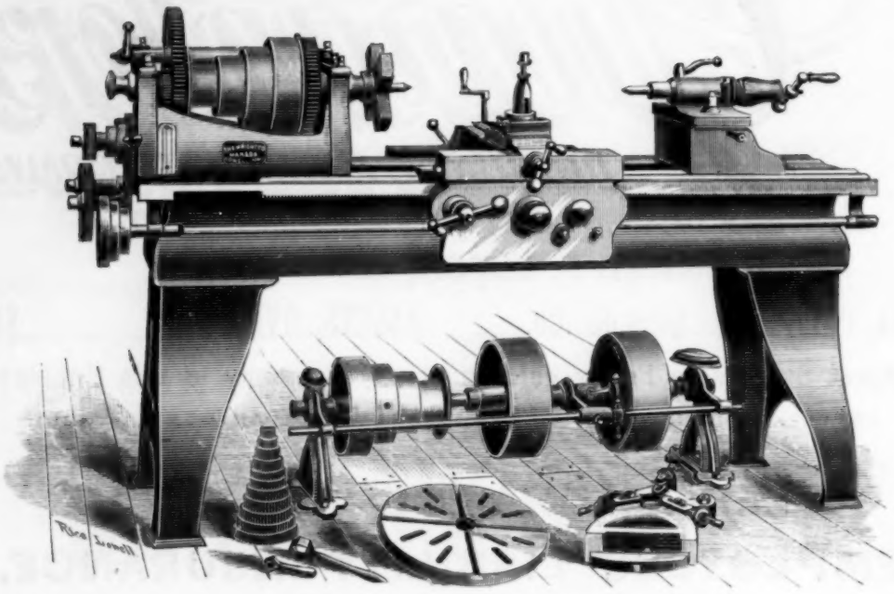

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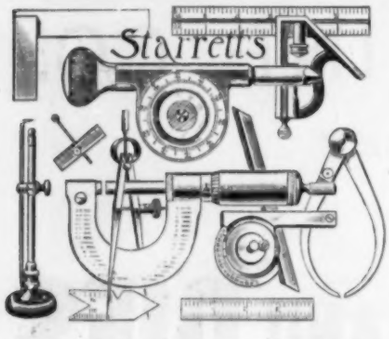

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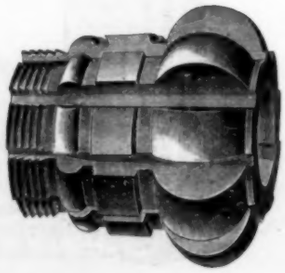
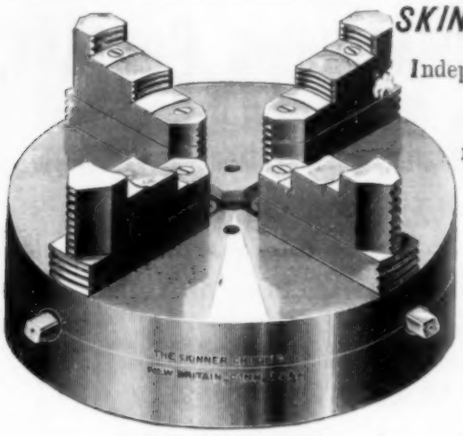


CUTTERS.



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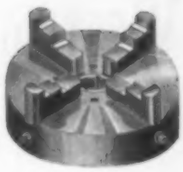

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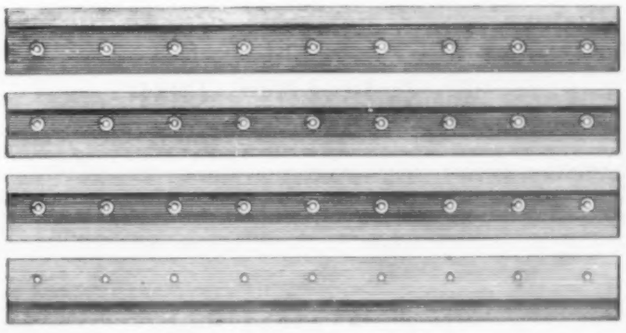

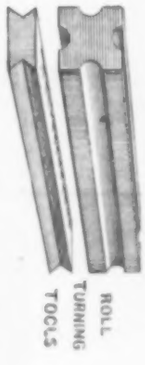

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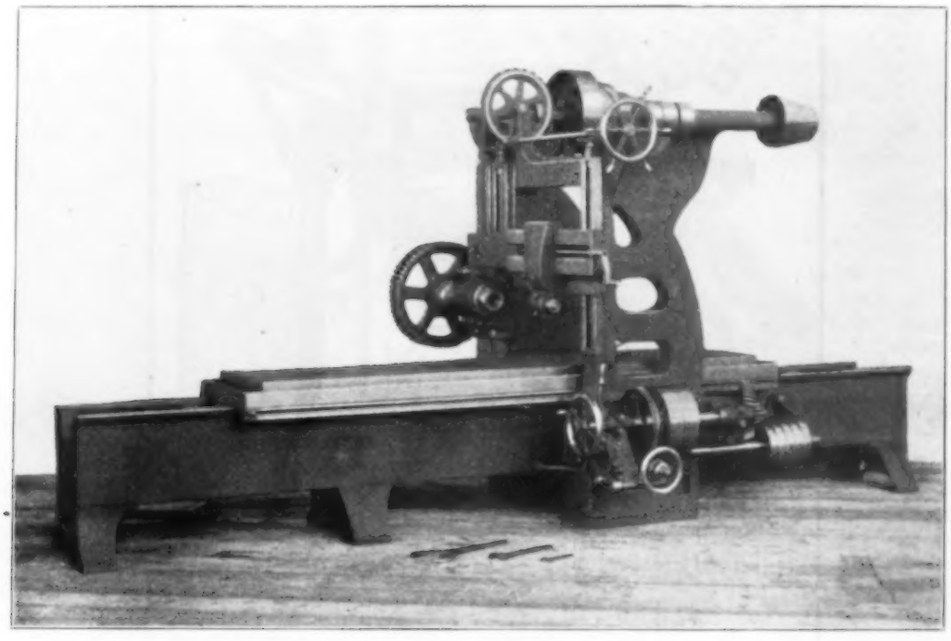

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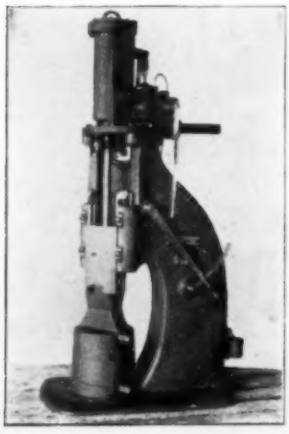

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Will never blow the castings.

Will *never make the core larger than the core-box*.

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Yields readily to the contraction of the metal while cooling, thus lessening the difficulty in removing the core.

REFERENCES:

Pennsylvania R. R., Altoona, Pa.
Pennsylvania Iron Works, Philadelphia.
Gray's Ferry Iron Foundry, Philadelphia.
A. Whitney & Sons, Philadelphia.
G. Rehmann & Co., Philadelphia.
Wm. S. Cooper Brass Works, Philadelphia.
Kinzer & Jones, Pittsburg.
Damascus Bronze Co., Pittsburg.
Atwood & McCaffrey, Pittsburg.
Hydraulic Machine Co., Pittsburg.
Pusey & Jones, Wilmington, Del.
The Johnson Company, Johnstown, Pa.
Flint, Walling & Co., Kendallville, Ind.
Cox & Sons Co., Bridgeport, N. J.
Williamsport Machine Co., Williamsport, Pa.

Send for samples and price. **American Glutrose Works,**

FACTORIES:
Camden, N. J., Merchantville, N. J.

Offices, Penn Mutual Building,
925 Chestnut St., PHILADELPHIA.

It is not well to overlook a most probable fact that since 1870 **Mr. Edward Brown**, 311 Walnut Street, Philadelphia, has manufactured and sold twice as many Pyrometers as all other makers combined. In Portables alone over 550 to Blast Furnace Companies.

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OF THE

Hot-Blast (or Graphite) Pyrometer—The only stationary Pyrometer now in general use for a red heat. Suitable for Iron Furnaces, Glass Works, Boiler Flues, etc.

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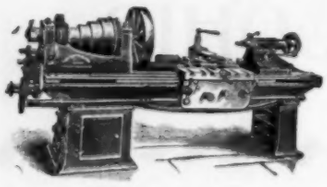
Water-current Pyrometer—of 1895, 3,000 deg.

Hobson and Siemen's Pyrometers, Mercury and Steam Gauges, Counters.

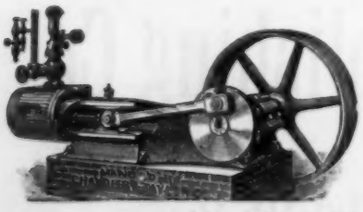


CLEVELAND, O., Dec. 20, 1895.

A recent visit to the offices and store-room of the American Tool Works, in this city, shows a busy state of affairs; the rap, tap, tap of the typewriter is engaging music, and it is stated by Mr. York that he is placing successfully many large machines. One of the largest ship building companies in the country report that the lathe they purchased of him two years ago is twice as valuable, and at half the cost of a competing lathe with which they compared it; and they have placed their order for $2000 worth of additional machinery with him. The proprietor presents an extensive list of second-hand machinery, and makes an innovation in this respect: that prices are published in full, showing the world what the goods can be sold at.

The cuts here shown illustrate the kind of machinery which is made a specialty of, consisting particularly of lathes, planers, drill presses, punch presses, steam engines, and boilers, steam pumps, pulleys, and power equipment machinery; and one is particularly struck with the low prices this company are making on the celebrated Otto Gas Engines.

Without doubt, Mr. York, the manager, will be very glad to answer all inquiries and furnish data that will be eminently advantageous to buyers needing this class of goods and speaking for him a successful business, with his very long experience, that has been always fully occupied, the writer believes it would be well for readers of this paper to communicate with him.



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Alice,	2 stacks.
DeBardeleben,	7 "
Ensley,	4 "
Sewanee,	1 "
Sheffield,	3 "
Sloss,	4 "
So. Pittsburg,	3 "
Watts,	2 "

SOUTHERN SOFTENER.

Spathite,	1 stack.

NORTHERN COKE.

Belfont,	1 stack.
Calumet,	1 "
Douglas,	2 "
Lincoln,	1 "
Niagara,	2 "
Port Henry,	1 "
River,	1 "

PENNSYLVANIA COKE.

Crane,	4 stacks.
Nittany,	1 "
Scottdale,	1 "

VIRGINIA COKE.

Big Stone Gap,	2 stacks.
Shenandoah,	1 "

LAKE SUPERIOR CHARCOAL.

Hinkle.

SOUTHERN CHARCOAL.

Rome (Car Wheel).
Jenifer (Car Wheel).
Mannie (Softener).
Round Mountain (Cold Blast).
Napier (Foundry).

HANGING ROCK CHARCOAL.

Centre.
Mt. Vernon.
Olive.
Hecla (Cold Blast).
Jefferson (Cold Blast).

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